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Essays on Taxation

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Essays on Taxation

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This dissertation contains three chapters that examine various behavioral responses to statutory tax policies. In the first chapter, I develop a framework to estimate the impact of the marriage tax on the likelihood of marriage that incorporates into one analysis all four distinct household alternatives: single, cohabit, married, and separated. This is in contrast to previous works that consider only one of three separate choices. Using data from the March CPS from 1989-1999, I estimate a bivariate probit model and find that the marriage tax has a small, but significant, effect on the likelihood of marriage. Furthermore, my results indicate that studies that do not include all four possible alternatives can overstate by as much as 200% the effect of the marriage tax on the likelihood of marriage.

The second chapter considers the net distributional impact of the federal tax deduction for charitable donations. If itemizers, who tend to have higher income than non-itemizers, give to charities that provide goods that they directly use or benefit from (egoism), the government is essentially subsidizing the activities of the high-income

donors. Conversely, if itemizers donate to organizations that benefit the needy (altruism), the tax deduction aids in a form of income redistribution. I estimate this tax responsiveness of giving using the Center on Philanthropy Panel Study (COPPS) module of the PSID in 2001 and 2003 for 11 types of charities. Donations by high income individuals to charities that benefit the poor are more price elastic than donations to charities that benefit themselves. I find evidence that the current tax deduction induces itemizers to donate more to charities that benefit the poor than they would have without the deduction.

The third chapter estimates the economic incidence of the excise tax on tobacco. Using historical price and tax data from 1954-2005, I estimate what portion of the tax is shifted to consumers. I experiment with controls for border crossing and indoor smoking bans. I find that a 10-cent tax increase causes price to increase by 8 cents immediately and by 13 cents in the long run.

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CHAPTER 1: HOUSEHOLD FORMATION AND THE “MARRIAGE TAX”: SHOULD I BE SINGLE, COHABIT, MARRY, OR SEPARATE?

1. INTRODUCTION

The personal income tax system in the United States defines the family as the unit of taxation. This distinction can cause married and unmarried couples with the same level of income to face different tax schedules, entirely due to their marital status. The resulting inequity is commonly called the “marriage tax”, although this tax could be positive or negative. Basic economic theory tells us that individuals respond to incentives. Using data from the March CPS from 1989-1999, and calculating tax liabilities using the NBER’s TAXSIM, I find evidence that couples who do not marry face a larger marriage penalty than married couples. For instance, married couples in these data receive an average marriage subsidy equal to \$178.65 while unmarried couples would face an average marriage penalty of \$100.34 if they were to marry. Thus, one might expect that a larger marriage tax might decrease the average marriage rate, all else equal.

This very hypothesis is explored in a growing body of literature that seeks to determine the effect of the marriage tax on the decision to marry which includes Alm and Whittington (1999, 2003), Dickert-Conlin and Houser (2002), and Eissa and Hoynes (2000b). These authors each estimate the choice between one of three combinations of two alternatives: the probability that unmarried people marry, the probability that cohabiters marry, and the probability that married couples separate. In general, they find that the tax has a negative, but tiny, effect on the likelihood of marriage.

None of the existing literature incorporates simultaneously into one model the four distinct alternatives: stay single, cohabit, marry, or separate. If all four alternatives are related, then the omission of any two choices may lead to biased estimates. For example, two single individuals do not have marriage as their only option. Instead, they could cohabit. In my framework each couple at each point in time can choose to be single, cohabit, marry, or separate. I develop an empirical model that allows each couple to choose one of these four alternatives, and that allows the tax law to influence these decisions. Comparisons of results between previous works are difficult not only because they examine the choice between different alternatives, but also because they measure the tax cost of marriage differently. I estimate my models using two different computations of the marriage tax. This allows me to judge if the tax cost variations in the literature are the cause of differences in the results.

I find that the net effect of the marriage tax on the likelihood of marriage is negative, but small, when all four possible alternatives are considered. Ultimately I want to know if the inclusion of all four alternatives yields different results from the models in the existing literature. Since each study uses a different data set, I also estimate a two alternative model where individuals can either marry or not, as in the previous works. The estimated tax price elasticity of marriage for household heads equals 0.0005 in the model that includes all four alternatives.¹ This is in contrast to 0.0009 and 0.0016 when I

¹ Throughout this chapter I use marginal effect to represent the change in the dependent variable for a given level change in the independent variable. So, the marginal effect of the marriage tax on the probability of marriage indicates the percent change in the likelihood of marriage for a *dollar* change in the marriage tax. This is in contrast to the elasticity, which represents the percentage change in the likelihood of marriage for a *percent* change in the marriage tax.

consider the choice between only two alternatives. Thus, I conclude that not delineating all four outcomes can overstate the effect of the tax on marriage by as much as 100%.

This chapter proceeds as follows. Section 2 contains a discussion of the implicit marriage tax as well as various methods employed in the literature of calculating this tax. Next, in section 3, I discuss the growing body of research that attempts to measure the effect of the marriage tax on marital decisions. I present my theoretical framework and specification in section 4. The data and results from this estimation procedure are contained in sections 5 and 6, respectively. Finally, section 7 concludes and contains a discussion of other avenues to pursue in future research.

2. BRIEF HISTORY OF THE MARRIAGE TAX

The marriage tax is not an actual tax. Policymakers never sat down and said, “Let’s levy an extra tax on married people!” Rather, it is a reality of any tax system with graduated marginal tax rates and the family as the unit of taxation. Rosen (1977), Lovell (1982), and Berliant and Rothstein (2003) each show that it is impossible to have a tax system that is non-linear, marriage-neutral, and horizontally equitable. Through its graduated tax schedule and goal of horizontal equity between families, the U.S. tax system therefore, necessarily violates marriage neutrality. Specifically, the differences in personal exemptions as well as tax bracket cutoffs for married and unmarried persons work together to create the marriage tax.

A large body of literature explores which individuals face this tax, and how it has changed over time, including Rosen (1987), Feenberg and Rosen (1995), Cataldo (1996), Alm and Whittington (1996) and Whittington and Alm (2001). In general they demonstrate that a pair of individuals with similar earnings tends to face a larger marriage

penalty because marriage pushes them into a higher tax bracket. Likewise, couples with dissimilar earnings may actually be in a lower tax bracket after marriage and could receive a marriage subsidy. Low-income families can face a particularly severe tax if they are pushed out of the bracket for Earned Income Tax Credit eligibility. In addition, Alm, Whittington, and Fletcher (2002) point out that the existence of a marriage subsidy implies a “singles tax” for many unmarried individuals.

2.1 DEFINITIONS OF THE MARRIAGE TAX

While it may seem simple to determine the level of the marriage tax, several different calculations are employed in the literature in ways that depend on the available data. The first, used by Eissa and Hoynes (2000a and 2000b) among others, calculates the total tax due as a married couple and compares it to the sum of the taxes owed for each partner if they filed as single (or head of household). The difference between the two is called the tax cost of marriage. This approach is typically used when data are observed for married couples, and then a separation must be simulated for each couple to determine the tax if unmarried. For a married couple with individuals i and j , and with number of kids K , the marriage tax, T , is calculated from the tax function, t , as:

$$T \equiv t(E_i + E_j, UE_i + UE_j, K, S_{married}) - \left[t\left(E_i, \frac{1}{2}(UE_i + UE_j), 0, S_{single}\right) + t\left(E_j, \frac{1}{2}(UE_i + UE_j), K, S_{head}\right) \right], \quad (1.1)$$

where E = earnings

UE = unearned income

S = tax schedule: (for married, single, or head of household).

Thus, equation (1.1) states that the marriage tax equals the joint tax liability while married less the sum of the tax liability as head of household for the partner that receives custody of the children, person j , and the tax liability as single for the other partner, person i . Given data limitations, several assumptions are key in this approach.

- (i) Everyone takes the standard deduction.
- (ii) Unearned Income is split equally when not married.
- (iii) Custody of any children
 - a. Eissa and Hoynes (2000a,b), Dickert-Conlin and Houser (1999) assume that the female receives custody and files as head of household upon divorce.
 - b. Rosen (1987), Feenberg and Rosen (1995) assume that the spouse with the highest earned income receives custody upon divorce.

My data are similar to theirs, so I must make similar assumptions. I try it both ways.

That is, I use T^W to denote the marriage tax as defined by equation (1.1) when j represents the woman who receives custody of any children and files as head of household when unmarried. Similarly, T^{PE} denotes equation (1.1) when j represents the primary earner.

That approach yields the marriage tax for the couple, and this T is assigned to each individual within the couple faced with the decision to marry. To get the marriage penalty faced by an individual, Alm and Whittington (1997, 1999) assign each person a share of the total tax liability when married and then subtract the appropriate (single or head of household) unmarried tax liability. To calculate the share of married tax liability for the primary earner, that person's income is taxed according to the married tax schedule, while for the secondary earner, that person's income is added to the primary earner's income and then taxed at the resulting higher marginal tax rate of the graduated tax brackets for married couples. For both, the tax liability while married is determined

by the married tax schedule, but only the secondary earner's share of the tax while married is a function of both incomes. If the two incomes are very dissimilar, this method allows the primary earner to receive a marriage subsidy while the secondary earner experiences a marriage tax. A problem with this measure is that it assigns different tax incentives to the two individuals considering marriage, even though it is a joint decision that could easily involve some kind of bargaining over reallocation of resources inside the household after marriage. If net income is shared equally, for example, then both are equally affected by the marriage tax (or subsidy). Thus, I compute the marriage tax according to equation (1.1), which assigns the same tax cost of marriage to each partner.

3. PREVIOUS LITERATURE

Studies that examine the effect of the marriage tax on marital decisions can be grouped into three categories. The earliest works use time-series data to draw conclusions about aggregate marriage rates. The second wave uses individual household data to estimate hazard models of the length and timing of marriage and divorce. Finally, those in the third group explain static individual level decisions to marry.

3.1 AGGREGATE MARRIAGE RATES

Alm and Whittington (1995a) use time-series data spanning 1947-1988 to estimate the effect of the marriage tax on the aggregate marriage rate. They define the marriage tax as the difference between the tax if married and the sum of the singles taxes for males and females, all evaluated at median levels of income. With the percent of women age 15-44 that are married as the dependent variable, they find a marriage-tax elasticity that is negative and less than 0.05 in absolute value for every specification used.

Thus, the tax does have a slightly negative effect on marriage, but it is very small. Sjoquist and Walker (1995) use the percent of unmarried women that marry in a given year between 1948 and 1987 as their dependent variable, and find the marriage tax has no significant explanatory power. However, they do find evidence that the marriage tax may lead some couples to postpone a marriage until the following tax year, although the effect again is very small.

Later the same year, Alm and Whittington (1995b) explore the contrast in these two results – one showing a small negative effect on the marriage rate, and the other showing no effect. They conclude that these time-series estimates are sensitive to the specification and method of estimation. Specifically, any estimated effects of the tax on marital decisions are small and likely do not affect many individuals. Thus, they propose using individual level data in the future.

3.2 LENGTH AND TIMING OF MARRIAGE AND DIVORCE

The second wave of research focuses on the timing of various marital decisions. Using longitudinal data from the PSID, Alm and Whittington (1997) estimate the probability of delaying marriage as a function of the marriage tax for individuals in the sample who do eventually marry. Their estimates indicate that the marriage tax may lead to a delay in marriage for less than 2 percent of couples. Alm and Whittington (1999) use the same data to estimate a discrete hazard model of time until first marriage. For women, they find that the difference in tax liabilities between married and single women leads to a small, negative impact on the likelihood of marriage. Conversely, the same effect for men is insignificant.

In a separate 1997 paper, Whittington and Alm use a similar model to estimate the probability of divorce as a function of the tax for individuals in their first marriage. The marriage tax here leads to a larger, positive effect on the probability of divorce. The magnitude varies between men and women, however. In particular, for women the estimated marriage tax elasticity ranges from 0.73 to 1.05 depending on the definition of the marriage tax, while for men the elasticity is around 0.38. While the influence of the tax on a particular individual is small in all three of these cases, the impact is still significant. Thus, they conclude that the tax differential influences some marital decisions, at least at the margin.

The differences across genders in these results are misleading since their definition of the marriage tax gives the entire disincentive to the secondary earner (primarily women), while the primary earners (men) enjoy a subsidy, on average. The decision to marry is made by a couple, and each partner should experience the same net tax consequences.

3.3 PROBABILITY OF MARRIAGE

The third category includes research that examines the probability of marriage given that the individual is single or cohabits, as well as the probability of divorce or separation given that the individual is married. In addition to the tax cost of marriage from the federal income tax, some of these papers consider various transfer programs and the EITC for low-income families. Table 1.1 provides a succinct listing of these papers, grouped by the alternatives that they consider. In general, they all find a negative, but small, effect of the tax penalty on the decision to marry, regardless of the alternatives considered, or the measurement of the penalty.

Dickert-Conlin and Houser (2002) are the only ones to consider single people, though they do not do so explicitly. They estimate the decision to marry for a sample of unmarried women that includes single women as well as cohabiters as a function of changes in the EITC for low-income women. They find that the EITC has no effect on the probability of marriage for unmarried women with children. For married women with children, however, the EITC does affect the decision to remain married with an estimated elasticity of marriage of 0.011. Thus, if the EITC is higher when not married, the probability of marriage declines. Dickert-Conlin (1999) finds an even smaller elasticity, 0.0041, when considering jointly the changes in federal income tax liability and the benefits received from various transfer programs for low-income women.

Eissa and Hoynes (2000b) and Alm and Whittington (2003) both estimate the likelihood of marriage given cohabitation. A main difference is that Eissa and Hoynes utilize a repeated cross-section of individuals from the March CPS, and thus do not observe if a cohabiter actually marries. Rather, their estimates rely on the percent of individuals that are married or cohabit in a given year. In contrast, Alm and Whittington use a panel data set and observe changes in marital status for specific individuals. The marginal effect of the marriage tax with respect to marriage in the Alm and Whittington analysis is -0.00002, which is much smaller than the -0.004 that Eissa and Hoynes find. However, this difference is not necessarily due to the advantage of longitudinal data. Rather, Eissa and Hoynes consider only women, while Alm and Whittington include both men and women. In addition, they define the tax cost of marriage somewhat differently. Eissa and Hoynes use T^W while Alm and Whittington use T^{PE} . As I illustrate using my

data in Section 5, the use of T^W leads to an average marriage subsidy for married couples, while the use of T^{PE} leads to an average marriage tax.

The tax elasticity of marriage ranges from 0.011 to 0.100 in these studies. However, these variations are difficult to compare due to the lack of a consistent measure of the marriage tax as well as differences in the groups of individuals considered. In addition, each study considers a choice between only two alternatives. At a given point in time, an individual does not have just two alternatives. For instance a couple that cohabits does not have marriage as its only option -- it could also split up and become two single individuals. Similarly, single individuals can choose to marry, or they could instead choose to cohabit. The omission of this other choice may lead to biased estimates, a problem that is addressed in my analysis. I incorporate all four alternatives (single, cohabit, married, separate) into one model and then determine the effect of the marriage tax on the probability of marriage.

4. THEORETICAL FRAMEWORK AND EMPIRICAL SPECIFICATION

Every period in my model each individual simultaneously makes two choices. One choice is whether to live *alone* or not (that is, to live with any other adult in a partnered relationship or not). The other choice is whether to *marry* or not. Jointly, these two choices yield the four possible alternatives depicted in Figure 1.1. Thus, the word “single” in this analysis includes only persons who are both not married and not living with a partner. Those who live with an unrelated adult and are unmarried are said to “cohabit”. The term “married” here includes all those with a legal marriage who also reside in the same household as their spouse; individuals are called “separated” if they reside in a different household from their spouse.

FIGURE 1.1 FOUR STATES FOR HOUSEHOLD STATUS

	<i>Marry</i>	<i>Not Marry</i>
<i>Alone</i>	Separated	Single
<i>Not Alone</i>	Married	Cohabit

The traditional approach is to use the theory of marriage and equilibrium of the marriage market developed by Becker (1973, 1974). In short, individuals marry if their utility while married is greater than while not married. Utility, then, is a function of marital status ($M = 0,1$), household production (Z_M), tax liability (T_M), and individual characteristics (X). Both household production and tax liability are dependent on marital status. Thus, in the traditional approach utility could be represented by $U = U(M, Z_M, T_M; X)$. Eissa and Hoynes (2000) note that this approach “makes no distinction between legal marriage and cohabitation...and therefore is just as applicable to analyzing cohabitation” (p.11). In other words, the important point about household production is not whether the pair of individuals are married or not (Z_M), but whether they live alone or not (Z_A for $A=0,1$).

My framework attempts to disentangle cohabitation from marriage (and separated from single) by combining the decision to live alone with the decision to marry. Each individual simultaneously chooses *alone* and *marry*. I represent an individual’s utility as

$$U = U(A, M, Z_A, T_M; X) \quad (1.2)$$

where A and M are dichotomous variables that represent the *alone* and *marry* decisions, respectively. Household production (Z_A) changes with *alone* status and includes things like household income to proxy for the added economies of scale and “marriage market”

characteristics. The tax cost of marriage, T_M , is simply the difference between the tax liability while married and the tax liability when unmarried. Each individual chooses the household status that yields the greatest utility.

Note that I assume that Z directly affects only the *alone* decision, and that T affects only the decision to *marry*. The marriage tax affects whether to marry, but given that choice, it has no effect on whether the individual lives alone or cohabits. As a result, the tax cost of marriage has the same effect on *marry* for all unmarried persons, whether they are single or cohabit. Likewise, the former assumption is that household production variables affect *alone*, but given that choice, they have no effect on the decision to marry. The added economies of scale and extra household income that come from living with a partner have no direct effect on marriage in this setup. “Marriage market” variables, like male/female ratios, are used in the Becker framework as a proxy for availability of a partner. Yet, this partner does not necessarily need to be a spouse in a legal marriage. Thus, I call these types of variables “partnership market” variables and use them as determinants of whether or not an individual will live alone in Z_A .

These two exclusion restrictions are necessary in order to identify the *alone* and *marry* decisions in the procedure that follows. I estimate a bivariate probit which includes an estimate for the correlation between the *alone* and *marry* decisions. If the correlation does not equal 0, then the marriage tax can affect the *alone* decision indirectly through the likelihood function. Likewise, the variables in Z_A may have an indirect effect on *marry*.

To parameterize this model, I define A^* as the difference in utility between the two *alone* states (for a given M).

$$A^* = U^*(1, M, Z_1, T_M; X) - U^*(0, M, Z_0, T_M; X) \quad (1.3)$$

Then, given $M = 1$ or $M = 0$, we have:

$$A = \begin{cases} 1 & \text{if } A^* > 0 \\ 0 & \text{if } A^* \leq 0 \end{cases} \quad (1.4)$$

which formalizes the *alone* decision of the individual.

In a similar fashion, an individual chooses to marry, given $A = 0$ or $A = 1$, according to:

$$M^* = U^*(A, 1, Z_A, T_1; X) - U^*(A, 0, Z_A, T_0; X), \text{ and} \quad (1.5)$$

$$M = \begin{cases} 1 & \text{if } M^* > 0 \\ 0 & \text{if } M^* \leq 0 \end{cases}. \quad (1.6)$$

Thus, the individual marries if the utility of marriage is higher than the utility when not married.

Next, I assume a linear form for the indirect utility function, to arrive at the following equations:

$$A_i^* = \mathbf{a} + \mathbf{b}Z + \mathbf{d}X + \mathbf{e}_i, \text{ and} \quad (1.7)$$

$$M_i^* = a + bT_i + dX + \mathbf{n}_i. \quad (1.8)$$

It follows that an individual lives alone if $\mathbf{a} + \mathbf{b}Z + \mathbf{d}X > \mathbf{e}_i$ and marries if

$a + bT_i + dX > \mathbf{n}_i$. More precisely,

$$\begin{aligned}
P(single) &= P(A = 1, M = 0) = P(A^* > 0, M^* \leq 0), \\
P(cohabit) &= P(A = 0, M = 0) = P(A^* \leq 0, M^* \leq 0), \\
P(married) &= P(A = 0, M = 1) = P(A^* \leq 0, M^* > 0), \text{ and} \\
P(seperated) &= P(A = 1, M = 1) = P(A^* > 0, M^* > 0).
\end{aligned} \tag{1.9}$$

Summing over the probabilities of the four states forms the following likelihood function:

$$\begin{aligned}
L_i &= A_i(1 - M_i)P(A_i^* > 0, M_i^* \leq 0) + (1 - A_i)P(A_i^* \leq 0, M_i^* \leq 0) \\
&\quad + (1 - A_i)M_iP(A_i^* \leq 0, M_i^* > 0) + A_iM_iP(A_i^* > 0, M_i^* > 0)
\end{aligned} \tag{1.10}$$

This can be solved by maximized likelihood. Note that this is exactly the procedure known as bivariate probit when the error terms are distributed bivariate normal. If the correlation coefficient between the two error terms, \mathbf{r} , is zero, then this is equivalent to estimating equations (1.7) and (1.8) with separate probits. In this case, “individuals” and “separated” persons with identical characteristics could have the same A_i^* , and similarly “married” and “separated” persons with identical characteristics could have the same M_i^* since *marry* does not enter into equation (1.7) directly, and conversely equation (1.8) does not contain *alone*. This implicit assumption has the potential to be restrictive if the two equations are estimated separately. However, because I assume that together they are distributed bivariate normal and that \mathbf{r} does not have to be zero, the probability of each outcome, P_{ij} , and the marginal effects of the covariates each depends on the *joint* estimation of the two equations. For example, the marginal effect of a demographic variable X_k on alternative married in this model can be computed as follows:

$$\frac{\partial P(A=0, M=1)}{\partial X_k} = f(-\mathbf{g}'_A X_A) \Phi \left(\frac{\mathbf{g}'_M X_M - \mathbf{r} \mathbf{g}'_A X_A}{\sqrt{1-\mathbf{r}^2}} \right) \mathbf{g}_{M_{X_k}} + f(\mathbf{g}'_M X_M) \Phi \left(\frac{-\mathbf{g}'_A X_A + \mathbf{r} \mathbf{g}'_M X_M}{\sqrt{1-\mathbf{r}^2}} \right) \mathbf{g}_{M_{X_k}} \quad (1.11)$$

where X_A is a matrix of all the covariates in the *alone* equation and X_M is a matrix of all the covariates in the *marry* equation, \mathbf{g}_A and \mathbf{g}_M are the estimated coefficient vectors corresponding to X_A and X_M , and \mathbf{r} is the estimated correlation coefficient.² If \mathbf{r} is 0 then the effect condenses to those found in a single equation probit. When \mathbf{r} is not 0, all of the coefficients from both equations affect each individual marginal effect and predicted probability.

Identification is achieved because the tax cost of marriage is excluded from the *alone* decision, while the household production and partnership market variables are excluded from the decision to *marry*. In addition, since I use cross-sections from 11 years (1989-99), tax cost variation is achieved both by the various changes in the statutory code over time (brackets, marginal tax rates, standard deductions, and the EITC) as well as by the cross-sectional variations in the tax cost of marriage for those with various income and household characteristics.

The fact that I exclude household production from the *marry* equation could be problematic if marriage behavior is in fact influenced by these variables. For instance, some religious couples cannot cohabit and thus cannot enjoy the added economies of scale of a two person household unless they marry. This assumption, while necessary for identification of the model, may prove to be restrictive if it is not representative of actual

behavior. A potential solution to this is the multinomial logit where the individual makes one choice over the four alternatives as well and no exclusion restrictions are necessary to identify the model. A major disadvantage, however, is the implicit assumption of independence of irrelevant alternatives. *Ex ante* this assumption does not seem appropriate for my model. For a pair of individuals, the choice to be married is not independent of the choice to cohabit if the marriage tax matters. For a married couple, separation is not independent of divorcing and living alone. As expected, this specification fails the Hausman test for IIA.³ I conclude that the bivariate probit model is a more appropriate representation of the individual's decisions and the data.⁴

5. DATA DESCRIPTION AND STATISTICS

I use data from the March CPS Annual Demographic Survey for the years 1989-1999. This data set has its advantages and disadvantages, but for my purposes the pros outweigh the cons. For instance, tax data have rich information on income, and accurate assessments of tax liability. Using CPS data requires that tax liability be estimated or constructed somehow, and the various assumptions required to do so may cause problems in the results. However, my analysis requires the distinction of household structure (single, cohabit, married, separated), which is not available from tax return data. Likewise, the CPS data have an abundance of other basic demographic variables not found in tax data.

First, I must separate each individual into one of the four groups. An unmarried person who resides in a household with no other adults is classified as "single". A

² See Greene (1998) for derivation.

³ Results available upon request.

“cohabiter” is any unmarried person who lives with one, unrelated, adult of the opposite sex. This definition necessarily omits groups of three or more adults that reside together (even if two of them are technically cohabiters, which I cannot tell from the data). In addition, I exclude all households with only two same-sex adults, since the decision to cohabit rather than marry is different for homosexual couples during this time period. They are not included in the legal definition of marriage, and the marriage tax is not something that could possibly deter them from marriage.⁵ Divorced persons and widowers are either single or cohabiters in this framework. Married persons are those who report ‘married, spouse present’ as their marital status. Separated individuals report either ‘married, spouse absent’ or ‘separated’. The CPS defines ‘separated’ in such a way that it includes those who are legally separated with those who simply have intent to become legally separated or divorced. I assume no person in this category has legally changed his or her marital status.

Clearly, these definitions are not without problems, but at this stage, I believe they are reasonable. Next, I restrict my analysis to persons between 18 and 64 years of age.⁶ Due to the sheer size of the remaining sample and the incumbent computational difficulties, I work with a ten percent random sample of 72,019 individuals.

I want to consider each pair of individuals as an observation since the *marry* and *alone* decisions are choices made by a couple or potential couple. Thus, I use only one individual from each pair in my analysis. I cannot simply look at all females or all males

⁴ Another possible model is the nested logit. It is theoretically unclear, however, in which order to do the nesting. Do couples decide to marry and then to live alone? Or, to live alone and then to marry?

⁵ If a time comes when marriage or civil-unions are legalized for homosexual couples, it would be important and interesting to include them.

because that would change the proportion of households that are *alone*. Since 62% of single and separated individuals are female in my data, examining only women overstates the percentage of pairs that live alone. Likewise, including only men understates the proportions that are single or separated. If this number was 50%, then considering only one gender would work. I use the household head from each pair in my analysis, where the household head is identified as such by the CPS.

Table 1.2 contains descriptive statistics for the household heads. Those who cohabit are youngest. Separated individuals have the least amount of education and are most likely to be not white. Married and separated couples have more children than their unmarried counterparts. Single and separated persons are more likely to reside in an MSA. Own earnings are greatest for married persons, while separated individuals have the least earnings. This is due to the way I have divided the data. Household heads tend to be male, and women earn less than men in my data. In fact, 84% of couples that are married or cohabit have a male head of household. When considering total earnings, married couples still have the most income, but cohabiters earn the least.

Next, I construct an indicator of the “partnership market”. This variable is used in Z as a proxy for the ease of finding a suitable partner. I use Lichter et al’s (1992) ratio of marriageable men to women by age and race categories for each state. Marriageable men are all men that are either in school or in the labor force.⁷ The partnerable men ratio (PMR) is then,

⁶ The very old may have incentives not to marry if, for instance, they receive monetary benefits from having a deceased spouse.

⁷ I also computed the same ratio for all men, regardless of labor force status. The results did not change.

$$PMR_{a,r} = \frac{\sum_{a-7}^{a+9} m_{a,r}}{\sum_{a-2} f_{a,r}} \quad (1.12)$$

where $m_{a,r}$ is the number of marriageable men of age a within a given race in a state, and $f_{a,r}$ is the total number of females of age a and race r in the state. They base this ratio on evidence that men tend to marry women who range from two years younger to seven year older than their own age. Conversely, they find women tend to marry men between their own age and nine years older. Table 1.2 indicates that the PMR is slightly larger for household heads who cohabit or are married. Thus, when the ratio of partnerable men to women increases, these individuals are more likely to live with another person.

5.1 TAX COST OF MARRIAGE

After categorizing each individual, I must determine the tax cost of marriage. I do this slightly differently for each group, due to various data limitations. The tax cost of marriage is the difference between tax liability when married and the tax liability when not married. To calculate the requisite tax liabilities, I use the NBER's TAXSIM model.⁸ Due to data limitations, each group of individuals requires different assumptions and necessary imputations. I describe the procedure for each group separately.

In order to calculate the tax liability while married, I need to know the amount of earned and unearned income for each partner and the total number of children or dependents. This calculation is straightforward for cohabiters and married couples, but

⁸ The NBER provides use of the TAXSIM to the public at www.nber.com/taxsim. Feenberg and Coutts (1993) provide an introduction to the use this model.

alone individuals pose a problem in that their potential partner is not observed (and spousal earnings are crucial to the calculation of the married tax liability). I estimate an equation for spousal earnings for the *not alone* couples, and use the resulting parameters to predict what income the *alone* person's potential spouse might have. Alm and Whittington (1999) perform similar imputations for single individuals. Thus, for the pool of married couples and cohabiters, I estimate the earnings of the partner of person i according to:

$$\begin{aligned} \text{partnerearnings}_i = & a_0 + a_1 \text{educ}_i + a_2 \text{educ}_i^2 + a_3 \text{exper}_i + a_4 \text{exper}_i^2 + a_5 \text{msa}_i + a_6 \text{notwhite}_i \\ & + a_7 \text{ownearnings}_i + a_8 \text{stateavgwage}_i + a_9 \text{fedminwage}_i \\ & + a_{10} \text{stateunemprate}_i + a_{11} \text{year}_i + e_i. \end{aligned} \quad (1.13)$$

Note that the independent variables depend only on person i , and not on person i 's potential partner. In this equation, *educ* is the persons education in years, *exper* is potential years of work experience defined as age less education less 6. Dummy variables indicate if the individual resides in an MSA or is not white. The earnings of person are contained in *ownearnings*. I estimate this equation separately for males and females.⁹ Identification is achieved because the statewide macroeconomic variables that may affect the partner's income are excluded from the *alone* and *marry* equations, and are not thought to influence either of those choices. These variables are the statewide average wage and unemployment rate and the federal minimum wage, each obtained from the Bureau of Labor Statistics. The estimated parameters are then applied to each *alone* person to predict what their potential partner would earn. Once the partner's

⁹ The results from this procedure are contained in Appendix 1A.

earnings are imputed, it is straightforward to calculate the tax liability while married for *not alone* people as well.

Next I must calculate the tax liability while not married for every individual. I assume each person retains his or her own reported unearned income. Persons who reside *alone* file either as head of household if any children are present, or as single if none are present. For *married* couples, I must make assumptions about who receives custody of the children. I do this two different ways. First I allow the woman to retain custody of any children and file as head of household, while the male would file as single (T^W). I also calculate tax liability where the primary earner receives custody of any children (T^{PE}). Couples who *cohabit* retain their own biological children. If they have children together, then custody is given to either the woman or the primary earner as for *married* couples. If there are no children present, both partners in a *not alone* couple file as single when not married.

Finally, I can calculate the marriage tax. Let T_M be tax liability while married, $T_{NM_i}^W$ be tax liability while not married for individual i when the woman gets the children, and $T_{NM_i}^{PE}$ be the tax where the primary earner retains custody. The subscripts i and j index each individual and their partner. (Note that $T_{NM_i}^W$ and $T_{NM_i}^{PE}$ are equivalent for single and separated individuals and cohabiters.) Then, let the tax cost of marriage for individual i be

$$T_i^W = T_M - T_{NM_i}^W - T_{NM_j}^W \quad (1.14)$$

assuming that the woman gets custody. Likewise, let the tax cost of marriage for individual i be

$$T_i^{PE} = T_M - T_{NM_i}^{PE} - T_{NM_j}^{PE} \quad (1.15)$$

for the case where the primary earner receives custody.

For *alone* persons, these two definitions of the marriage tax are difficult to compute. Each requires a calculation of the unmarried tax liability for the potential partner in addition to the person in question. I compute the tax liability of these hypothetical persons in the same manner as for single and separated outlined above treating the imputed partner's earnings as the hypothetical partners own earnings. I have no measure of the potential partner's unearned income, and simply assume it equals zero at this time. Thus, these two marriage tax definitions may not be precise for single and separated individuals, though the results are not biased by a meaningful amount.¹⁰

To see this, note that unearned income affects both T_M and T_{NM} for the potential partner. Thus, both tax liabilities will change if I let the partner's unearned income equal some nonzero amount: either the average of the sample, or an imputed value, or some other construct. Since the tax rate for a married couple is greater than or equal to the unmarried tax rate, the marriage tax could be a larger amount for *alone* persons if the potential partner's unearned income is not 0. For example, let j represent the potential partner of a single individual i and let each individual have mean earnings and assume

¹⁰ To circumvent these difficulties, I also define the marriage tax another way that is consistent across all four categories: $T_i^{WH} = \frac{1}{2} T_M - T_{NM_i}^W$ and $T_i^{PEH} = \frac{1}{2} T_M - T_{NM_i}^{PE}$. In these calculations, the marriage tax is equal to one half the tax liability while married less the particular individual's unmarried tax liability. However, these measures implicitly assign a positive marriage tax to secondary earners (women) and a negative tax to primary earners (men) which implies that the tax affects their decision to marry differently. Yet, the choice to marry is one made by a couple, and not by an individual.

person i has unearned income of \$500. Furthermore, assume there are no children and it is 1999 in Alabama. Using TAXSIM and assuming 0 unearned income for the potential partner, $T_i^W = 3802 - 1584 - 2008 = 210$. Now let the potential partner's unearned income be \$500 as well. The marriage tax becomes $T_i^W = 3877 - 1584 - 2085 = 210$, which is exactly the same as before. This result should hold as long as the unearned income does not cause the couple to face a larger tax rate while married than when single. In my data, the mean amount of unearned income for a single person is only \$141.28. Thus, assuming the potential partner has no unearned income is not expected to affect the results for the average individual.

The average tax rates for the four alternatives are contained in Table 1.2. If the tax cost is a disincentive to marriage, then married and separated individuals are expected to experience a smaller marriage tax than those who are single or cohabit. For T^W , this is precisely what occurs. Single individuals would pay an average of \$87.98 per year more in taxes if they married, while separated individuals only pay an additional \$3.18. Likewise, married couples tend to receive a subsidy of \$194.06 while couples who cohabit would pay \$184.20 more if they married. The primary earner receiving the kids, T^{PE} , is a tax-minimizing divorce strategy and so this measure yields a larger marriage tax. For example, married couples face a marriage tax that is about \$25 more than couples who cohabit when the tax is computed this way. However, 38% of *alone* women in my data have children in the household whereas only 8.7% of *alone* men have children, and primary earners are less likely to have children than secondary earners.

Thus T^W may represent more accurately than T^{PE} the way couples think about the tax cost of marriage.

Figure 1.2 contains a graph of the average value of T^W between 1989 and 1999, for each of the four alternatives. During this time period, the average amount of the tax trends upwards. Couples who cohabit always face a greater tax cost than married couples, on average. For instance in 1994 the average annual tax cost for a couple who cohabits is \$71.95, while it is -\$199.90 for a married couple. Single individuals pay a greater marriage tax than separated individuals prior to 1997 in my data.

6. EMPIRICAL RESULTS

I first estimate equation (1.10) via maximum likelihood for household heads. Coefficients from this procedure are contained in Table 1.3. Although the magnitudes are not meaningful, the signs of the variables point in the expected directions. In addition, all variables are significant at a 99% level of confidence with the exception of the terms for age and education in the *alone* equation. The likelihood an individual chooses *marry* decreases if that person is not white or lives in an MSA, and increases with the presence of children and age. The probability of living *alone* decreases with own earnings, education, the partnerable men ratio and the presence and number of children. Household heads are more likely to live alone if they are not white or live in an MSA. The parameter of interest, the marriage tax, has a negative effect on *marry*. The estimated correlation coefficient is -.918, indicating that these two choices are correlated highly.

Table 1.4 contains the corresponding marginal effects for each of the four alternatives evaluated at the means. All effects have the expected signs. The marginal

effect of the tax on the probability of being married is small in magnitude, $-1.18e-06$, and significant at the 95% level of confidence. With a mean tax of $-\$77.18$ and 63.03% of household heads predicted to be married, the implied elasticity is 0.00014. Thus doubling the marriage tax would change the proportion of married couples by .01 percent.

Next, I perform various checks for robustness and specification in Table 1.5. The previous results are replicated in the first row designated base case. Next, I add in fixed effects for states and years. State variables are important if people in different parts of the country have differing attitudes toward marriage, while the year variables capture unobserved changes in societal behavior over time. Neither state nor year variables change the base results by a significant amount.

I replace own and partner earnings with total earnings in my next specification check since much of the earlier literature uses total household earnings as a determinant of marriage. It is apparent from Tables 1.3 and 1.4 that own earnings and partner earnings affect the likelihood of marriage in opposing directions. For household heads, own earnings decrease the likelihood of living alone, presumably because higher earnings make them a better “catch” in the eyes of a potential partner. The partner’s earnings are generally smaller than own earnings because I am looking at household heads, and this causes partner earnings to increase the likelihood of living alone. Rather, this result simply reflects the fact that household heads that are married or cohabit have partners with smaller earnings than individuals who are single or separated. The point is that total earnings incorporate both own and partner earnings and are expected to have a smaller

effect on the likelihood function. In fact, the new marginal effects of the marriage tax when using total earnings are almost half as large in magnitude as the base case.

In the next row, I use T^{PE} as the measure of the marriage tax. This leads to an even smaller effect on the likelihood of marriage. With a mean tax of \$161.09 and 63.03% of households predicted to be married, the implied elasticity is 0.00027. However, since separated women are more likely to have children than separated men in my data, T^W reflects custody decisions more accurately.

6.1 COMPARISON WITH CHOICE MODELS HAVING ONLY TWO ALTERNATIVES

My estimates of the marginal effects are smaller than those of previous works. The major difference in the estimation procedure is that I incorporate all four potential alternatives, whereas others consider only two possible alternatives at a time. The influence of the marriage tax is smaller for every specification used here. This result is also invariant to the method used to calculate the marriage tax. Thus, previous estimates may suffer an omitted variable bias that overstates the size of the effect. However, I use different data, and years, and measure of the marriage tax, so direct comparison is impossible.

To compare my results to those that only consider two alternatives, I estimate a basic probit with *marry* as the dependent variable. As in the previous literature, I include all of the covariates from both the previous *alone* and *marry* equations in the base case into this regression. Table 1.6 contains these estimates. For household heads, the estimated marginal effect of T^W on the likelihood of marriage is -6.29e-06 evaluated at the means. This model predicts 68.7 percent of household heads are married, which yields an estimated tax-price elasticity of marriage of 0.0007. This is much larger than

the estimated 0.00014 elasticity in the base case. Furthermore, the marginal effects are more than twice as large in magnitude as in the results that include all four alternatives. I also examine the choice to *marry* for household heads who currently are either married or cohabit. This yields an estimated marginal effect of -9.85e-06. With a mean tax rate that equals -\$166.41 and 96.6% of households predicted to *marry*, the estimated tax-price elasticity is 0.0017. Taken together, my results indicate that studies that do not include all four possible outcomes can overstate by as much as 200% the effect of the marriage tax on the likelihood of marriage.

6.2 SIMULATIONS

I use results from the base case to simulate how the marriage tax affects individuals with various demographic characteristics. Table 1.7 examines how the marriage tax influences household formation decisions by age, race, and number of children. All calculations assume that the individual is a high school graduate with mean earnings and mean tax cost of marriage. Age, race, and number of children are at the levels indicated on the table. The remaining two variables, the partnerable men ratio and MSA dummy, are each set equal to the mean values.

In all cases, the probability of marriage and separation increases with age, while the likelihoods of single and cohabit decrease. Likewise, the elasticity of marriage with respect to the tax decreases with age. The youngest are about three times as sensitive to the marriage tax as older individuals, all else equal. White individuals are much more likely to marry than not white (76% versus 63% for an individual who is 35 years old with 1 child). Finally, having 1 child more than doubles the likelihood of marriage for the youngest individuals, and nearly doubles it for the oldest.

Next, I examine how the predicted outcomes change with the level of the marriage tax, all else equal. Table 1.8 contains predicted probabilities for each alternative by quartile of the marriage tax for a hypothetical white 35 year old with one child and a high school education. The predicted likelihood of marriage ranges from 77% in the bottom quartile to 70% in the top quartile. The estimated probabilities for single and separated both increase with the tax. Cohabitation is the only outcome that does not change with different levels of the tax perhaps indicating that couples who choose to cohabit are not sensitive to the marriage tax. This table illustrates how a decrease in the marriage tax can increase the likelihood of marriage.

7. CONCLUDING REMARKS

The purpose of my analysis is to determine the effect of the so-called marriage tax on the decision to marry. Previous studies only compare marriage to one other alternative. For instance, some of these papers compare married and cohabiting couples, while others compare married couples and separated individuals, or married couples and unmarried individuals. I incorporate into one cohesive model all four alternatives (single, cohabit, married, separated).

Using data from the March CPS from 1989-1999, I then estimate this model for household heads. My results show that estimates of the likelihood of marriage are sensitive to the method used to calculate the marriage tax. When I assume the wife gets the children the marginal effect is $-1.18e-06$, while the effect decreases in magnitude to $-1.57e-06$ when the primary earner retains custody. I find a tax-price elasticity of marriage equal to 0.00014 when the woman is assumed to receive custody of any

children evaluated at the means. This is one *quarter* the size of the elasticity I find when considering only two alternatives as in the previous literature: marry or not marry.

The potential endogeneity between the marriage tax and the earnings of the secondary earner could pose problems for estimating equation (1.10). If couples marry to minimize tax liability, then married couples will tend to have similar incomes, while couples who cohabit will have dissimilar earnings. My model assumes that couples who cohabit pool their incomes and allocate household resources the same way as married couples. This is a strong assumption. If cohabiters do not pool income, my results could overstate the proportion of couples who cohabit, and understate single and separated. In fact, when I use total earnings instead of separating own and partner earnings as a proxy for household economies of scale the predicted likelihood of cohabit does decrease from 4.87% in the base case to 4.48% while single and separated each increase. However, this change is small enough that I do not think it affects my main conclusions.

CHAPTER 2. COMPOSITION OF CHARITABLE GIVING AND THE FEDERAL INCOME TAX

1. INTRODUCTION

Since the War Revenue Act of 1917, the federal government has allowed some taxpayers to deduct contributions to charitable organizations from their income when calculating federal income tax liability. The deduction was included in this act to pacify fears that newly taxed individuals with high-income would cease their donations to institutions of higher learning. The tax act allowed deductions for “contributions or gifts actually made within the year to corporations or associations organized and operated exclusively for religious, charitable, scientific, or educational purposes, or to societies for the prevention of cruelty to children or animals,” (Aprill 2001). Congress, in 1944, extended the income tax to include more individuals, not just the very wealthy. In fact the percentage of individuals subject to the income tax increased from 5 to 74 percent. At this time the standard deduction was introduced and much debate centered on whether non-itemizers should be allowed to deduct their charitable contributions. Proponents of the standard deduction argued that the average charitable contribution of two and half percent was taken into account in setting the standard deduction. The opponents argued that donations to charity provide a public good, and should be tax exempt to encourage contributions to institutions that benefit society.

Over time the definition of a charity has evolved to include any organization that defines its purpose as religious, educational, literary, scientific, prevention of cruelty to

children or animals as well as fraternal societies and veterans' associations¹. Clearly, some of these organizations benefit the poor more than others. The purpose of this analysis is to see what types of organizations individuals donate to, and in turn if the deduction influences individuals to donate to organizations that benefit the needy more or less than other charitable organizations.

This has important policy implications. Only those taxpayers with total itemized deductions greater than the standard deduction can deduct their charitable contributions.² Itemizers tend to be wealthier than non-itemizers because a large component of itemization comes from mortgage interest and property taxes, and homeownership is positively correlated with income and wealth. If the higher income taxpayers who itemize choose to donate to organizations that benefit the needy, then the income tax deduction is, in essence, a form of government subsidized income redistribution. On the other hand, if itemizers donate to charities that provide services that benefit themselves and not the poor, the government is essentially subsidizing the activities of the rich.

I first present a simple theoretical framework of warm-glow giving. The model illustrates how a donor may give more to one particular charity if it makes them feel better to do so, or if it provides a larger warm-glow. I make no assumption about why the warm-glow is larger for one charity than another. It may be the case that these donors wish to see their donations serve the needy. In this case, an organization that benefits the needy produces a larger warm-glow than one that does not benefit the needy. Likewise, donors may prefer giving to organizations that provide services that they use. Either way,

¹ See IRS Publication 526, "Charitable Contributions".

² The exception is in 1986 when all taxpayers were allowed to deduct charitable gifts in addition to the standard deduction.

this framework allows individuals to choose which charity to donate to based on how it makes them feel. Whether donors receive a larger warm-glow giving to organizations that benefit the needy or not, is an empirical question.

Previous works estimate the tax-price elasticity for charitable contributions in order to address whether the deduction influences donation behavior.³ They also examine demographic characteristics of the donors. No one, however, has asked if the donations go to organizations that aid the needy.

To answer this question, I need micro data on individual giving to specific types of organizations as well as a measure of whether and how the various non-profits use their funds to help the poor. The first type of data is not difficult to acquire. I use the Center on Philanthropy Panel Study (COPPS) module in the Panel Study of Income Dynamics (PSID) in 2001 and 2003. This survey contains data on giving for 11 different categories of charitable organizations. The last major study with as much detail was performed in 1974, the National Study of Philanthropy. In addition to being timelier, the PSID has better income data, which are necessary to compute marginal tax rates.

Using results from existing literature, I develop an index for each of the 11 categories of non-profits that indicates what percentage of total expenditures benefits the needy. Then I use this ratio to see if individuals give more to organizations that benefit the poor. Furthermore, I test if giving to organizations that benefit the needy varies with income. My results indicate that the tax deduction causes donors to behave altruistically. While wealth itemizers donate the largest amounts to the arts and education, I find evidence that the tax deduction causes them to increase their donations to organizations

that benefit the poor. Any price decrease (tax increase) is predicted to cause the largest increases in giving to organizations that benefit the poor. I perform several policy simulations that change the tax treatment of donations. In all cases, the largest percent changes in giving are in donations to the poor.

2. THEORETICAL MODEL OF WARM-GLOW GIVING

The basic model of individual giving to public goods first developed by Gary Becker in 1976 gives each individual a utility function over both a private good and a public good. Individuals maximize utility subject to the constraint that income equals spending on the private good and donations to the public good. This model of public goods accounts for giving motivated by altruism, and ignores the fact that individuals may gain satisfaction from the act of giving. Over time, the preferred model has evolved into one that allows individuals to receive a “warm-glow” from giving (Andreoni 1989, 1990). The warm-glow model recognizes that the act of giving to a charity may provide positive utility to the donor. Individual utility can be represented by

$$U_i = U(x_i, G, g_i) \quad (2.1)$$

where x_i is the private good, g_i is the amount donated to charity, and $G = \sum g_i$ is the total amount of public good provided by the charity. The addition of the donated amount into the utility function captures the warm-glow that the individual receives from the act of donating, while the second term reflects the utility the individual gets from the presence of or use of the public good. If m_i represents individual income, and

³. Notable works include Feldstein (1976), Randolph (1995), and Auten, Sieg, and Clotfelter (2002). Clotfelter (1985) and Andreoni (2005) provide excellent reviews of this immense literature

$G_{-i} = \sum_{j \neq i} g_j$ represents all other individual donations, the individual's problem can be expressed as:

$$\max U(x_i, G, G - G_{-i}) \text{ s.t. } x_i + G - G_{-i} = m_i. \quad (2.2)$$

Andreoni (1990, 2005) shows that at Nash equilibrium, assuming all individuals are identical, $g_i^* = f_i(m_i + G_{-i}, G_{-i}) - G_{-i}$.

To illustrate this, consider a Cobb-Douglas utility function so that

$$U_i = \ln(x_i) + \mathbf{a} \ln(G) + \mathbf{b} \ln(g_i). \quad (2.3)$$

The warm-glow the individual receives from a donation is represented by \mathbf{b} , while \mathbf{a} characterizes the utility enjoyed from the public good created by the charity. At the Nash equilibrium solution with n identical individuals so that $G^* = ng^*$,

$$g^* = \frac{m(\mathbf{a} + n\mathbf{b})}{\mathbf{a} + \mathbf{b} + n}. \quad (2.4)$$

Thus an individual's donation to the charity is a function of his or her own income, the utility received from the public good, the warm-glow received from the donation, and the total number of people.

As a more interesting scenario, consider a world with two charities that provide two distinct public goods. One charity provides a good that traditionally benefits the poor (G_L) and the other provides a good that tends to benefit the wealthy (G_H). For instance, G_L could be a soup kitchen while G_H is an art museum. Assuming a Cobb-Douglas utility function, individual utility is:

$$U_i = \ln(x_i) + \mathbf{a}_L \ln(G_L) + \mathbf{b}_L \ln(g_{Li}) + \mathbf{a}_H \ln(G_H) + \mathbf{b}_H \ln(g_{Hi}) \quad (2.5)$$

Notice that the warm-glow may not be the same for donations to the two charities if $\mathbf{b}_L \neq \mathbf{b}_H$. Likewise, when $\mathbf{a}_H \neq \mathbf{a}_L$, the public goods provide different amounts of utility to the individual. Let t_i denote the marginal tax rate for individual i , so that the price of giving is $1-t_i$ if the individual can itemize their contributions. Then, the budget constraint for each individual is $m_i = x_i - (1-t_i)(g_{Li} + g_{Hi})$.

Suppose that there are two types of individuals: rich (R) and poor (P). Rich individuals use and benefit from G_H , while poor individuals use and benefit from G_L . If the poor make no donations, so that $g_{LP}^* = 0$ and $g_{HP}^* = 0$, then at the Nash equilibrium $G_L^* = n_R g_{LR}^*$, $G_H^* = n_R g_{HR}^*$, and

$$g_{HR}^* = \frac{m_R n_R (\mathbf{a}_{HR} + n_R \mathbf{b}_{HR})}{(1-t_R)(n_R + \mathbf{a}_{LR} + n_R \mathbf{b}_{LR} + \mathbf{a}_{HR} + n_R \mathbf{b}_{HR})} \quad (2.6)$$

$$g_{LR}^* = \frac{m_R n_R (\mathbf{a}_{LR} + n_R \mathbf{b}_{LR})}{(1-t_R)(n_R + \mathbf{a}_{LR} + n_R \mathbf{b}_{LR} + \mathbf{a}_{HR} + n_R \mathbf{b}_{HR})} \quad (2.7)$$

Notice that the denominators for the two donation amounts are the same. Thus, the rich individual donates more to the art museum than to the soup kitchen if

$$\frac{\mathbf{a}_{HR}}{n_R} + \mathbf{b}_{HR} > \frac{\mathbf{a}_{LR}}{n_R} + \mathbf{b}_{LR}.$$

Several interesting scenarios can occur. Suppose that the donor

receives no warm-glow from donations to the soup kitchen ($\mathbf{b}_{LR} = 0$), and that donations to the art museum produce a positive warm-glow ($\mathbf{b}_{HR} > 0$). Then the rich individual

gives more to the art museum than to the soup kitchen as long as $\frac{\mathbf{a}_{HR}}{n_R} + \mathbf{b}_{HR} > \frac{\mathbf{a}_{LR}}{n_R}$.

Conversely, the donation to the soup kitchen will be larger if the utility from the presence of the soup kitchen divided by the total number of donors is greater than the combined utility of the art museum and the warm-glow from giving to the museum. If the two goods provide equal utility $a_{LR} = a_{HR}$, individuals give to whichever good makes them feel better about their gift, or whichever has the larger b .

Now suppose that both types of individuals make donations. Each type maximizes utility according to (2.5). At the Nash equilibrium $G_L^* = n_R g_{LR}^* + n_P g_{LP}^*$ and $G_H^* = n_R g_{HR}^* + n_P g_{HP}^*$ where n_R denotes the number of high-income individuals and n_P represents the number of low-income individuals. The first order conditions require that:

$$\frac{1-t_R}{m_R - g_{LR} - g_{HR}} = \frac{a_{LR}}{n_R g_{LR} + n_P g_{LP}} + \frac{b_{LR}}{g_{LR}} = \frac{a_{HR}}{n_R g_{HR} + n_P g_{HP}} + \frac{b_{HR}}{g_{HR}} = 0, \text{ and} \quad (2.8)$$

$$\frac{1-t_P}{m_P - g_{LP} - g_{HP}} = \frac{a_{LP}}{n_R g_{LR} + n_P g_{LP}} + \frac{b_{LP}}{g_{LP}} = \frac{a_{HP}}{n_R g_{HR} + n_P g_{HP}} + \frac{b_{HP}}{g_{HP}} = 0 \quad (2.9)$$

The equilibrium solution is difficult to solve because donations by the rich are dependent on the level of donations by the poor, and vice versa. Instead, I consider two special separating cases that illustrate what can occur at the extremes.

First, consider the case of “pure egoism”. In this case, each type of donor only donates to the charity that they benefit from and/or use. This means that the poor give nothing to G_H , $g_{HP}^* = 0$, and the rich donate nothing to G_L , $g_{LR}^* = 0$. Note that this implies that $b_{LR} = 0$ and $b_{HP} = 0$, or donors receive no warm-glow from the charities that they do not use. Then, simple algebra implies that:

$$\begin{aligned}
g_{LP}^* &= \frac{m_P(\mathbf{a}_{LP} + n_P \mathbf{b}_{LP})}{(1-t_P)(n_P + \mathbf{a}_{LP} + n_P \mathbf{b}_{LP})} \\
g_{HR}^* &= \frac{m_R(\mathbf{a}_{HR} + n_R \mathbf{b}_{HR})}{(1-t_R)(n_R + \mathbf{a}_{HR} + n_R \mathbf{b}_{HR})}
\end{aligned} \tag{2.10}$$

In this separating outcome, the donation by one type of individual is independent of the preferences of the other type of individual.

Next, consider the case of “pure altruism”. Each type of individual gives only to the charity that they do not use or benefit from. The poor give nothing to the soup kitchen, $g_{LP}^* = 0$, and the rich give nothing to the art museum, $g_{HR}^* = 0$. This implies that the poor receive no warm-glow from the soup kitchen and the rich receive no warm-glow from the art museum, $\mathbf{b}_{HR} = \mathbf{b}_{LP} = 0$. As with “pure egoism”, it is simple to show that:

$$\begin{aligned}
g_{LR}^* &= \frac{m_R(\mathbf{a}_{LR} + n_R \mathbf{b}_{LR})}{(1-t_R)(n_R + \mathbf{a}_{LR} + n_R \mathbf{b}_{LR})} \\
g_{HP}^* &= \frac{m_P(\mathbf{a}_{HP} + n_P \mathbf{b}_{HP})}{(1-t_P)(n_P + \mathbf{a}_{HP} + n_P \mathbf{b}_{HP})}
\end{aligned} \tag{2.11}$$

Clearly this is an over simplistic representation of the problem, but it illustrates the basic motivation of my research. Since charities provide different public goods, two potential donors may choose to donate to different charities if they receive different levels of satisfaction, or warm-glow, from those donations. Both charities provide public goods, so why does it matter who funds each charity? The answer is the income tax deduction for charitable contributions, which is taken primarily by those with higher incomes. If high-income individuals choose to give more to charities that provide goods that they directly use or benefit from, the government is essentially subsidizing their

activities. On the other hand, high-income individuals may donate to charities that benefit the needy and the tax deduction results in a form of income redistribution.

In my empirics, I differentiate between types of charities by how much they benefit the poor. The truly altruistic individual gets more utility from the public good provided by the charities that help the poor ($\mathbf{a}_L > \mathbf{a}_H$) and possibly even a larger warm-glow ($\mathbf{b}_L > \mathbf{b}_H$). Of course, the purely self-interested individual may have $\mathbf{b}_L < \mathbf{b}_H$ and $\mathbf{a}_L < \mathbf{a}_H$. This is empirically testable. Rather, I can test if those with higher income give to charities that help the poor or to charities that benefit the rich.

3. EMPIRICAL STRATEGY

Many previous works that estimate the price elasticity of giving include Reece (1979), Feldstein (1975), Randolph (1995), and Auten et al (2002). The basic specification is a log-log form like the following:

$$\ln(g_i) = \mathbf{b}_p \ln(P_i) + \mathbf{b}_y \ln(Y_i) + \mathbf{b} X_i + \mathbf{e}_i \quad (2.12)$$

where g_i represents total individual donations, Y_i denotes income, and X_i is a matrix of relevant demographic characteristics. The price of giving is one dollar for non-itemizers, and one minus the marginal tax rate, $P_i = 1 - t_i$, for itemizers. Then \mathbf{b}_p and \mathbf{b}_y are the price and income elasticities of giving, respectively. Notice that the gifts made by other individuals do not enter (2.12). Andreoni and Scholz (1998) test this exclusion and find that gifts made by an individual are not dependent on the gifts of others at the margin.

The previous literature contains two different measures of the marginal tax rate. First, the donor's actual marginal tax rate is the incentive at the margin to give one more dollar, but it is determined in part by the total amount given and is therefore endogenous.

For this reason, researches calculate the “first dollar” tax rate as the marginal tax rate for the first dollar donated to charity. That is, the tax rate is computed as if no donations are made to charity. Since the “first dollar” measure of price is presumably uncorrelated with the after tax level of giving, many researchers use this tax to correct for the endogeneity problem. Others use the last dollar price and instrument for it using the first dollar price. I use the first dollar price.

Two separate income measures are used in the literature: gross income and after-tax income. Any measure of after-tax income must be adjusted to the level it would be if giving were zero since after-tax income depends on the level of charitable giving. I use total pre-tax income, since it is less likely to suffer the endogeneity problems of after-tax income and more likely to be independent of any other tax avoidance decisions.

Since many families donate nothing to charity, $g_i = 0$, equation (2.12) is estimated via a Tobit model, which accounts for the common corner solution. Furthermore since $\log(0)$ is undefined, I use the usual solution of adding \$10 to both g_i and y_i .

I want to determine if the deduction for charitable contributions influences whether or not individuals give to organizations that benefit the poor. Let I_j be the index measure of how well charities of type j benefit the needy. An index value of 1 means that type of charity spends 100% of its resources on the needy; while a value of 0 means that none of its resources benefit the needy. Let $GN_i = \sum_{j=1}^{11} I_j g_{ij}$ denote a measure of total gifts to the needy by individual i . Then I can estimate

$$\ln(GN_i) = \mathbf{b}_p \ln(P_i) + \mathbf{b}_y \ln(Y_i) + \mathbf{b}X + \mathbf{e}_i \quad (2.13)$$

to find the price and income elasticities of giving to charitable organizations that benefit the poor. I also estimate separate versions of (2.12) for each category of charity, where the dependent variable is total donations to that category.

In order to determine if giving to the needy varies with income, I add splines in income and price. This allows the slopes of the elasticities to change at specified points.

I compare income and price elasticities across categories and income groups in order to test if individuals are altruistic or egoists. For example, suppose one category is called Soup Kitchen and has an income elasticity of 0.3 and another category for Arts has an income elasticity of 0.5. Then a 10% increase in income causes a 30% increase in giving to the Arts, and a 30% increase in giving to Soup Kitchens. If the elasticity estimates are for a rich individual, they provide evidence of egoism. They give more, at the margin, to organizations that benefit themselves. Conversely, if the elasticity estimates are for a poor individual, the results imply altruism. They give more to organizations that benefit others.⁴ I also look at total giving to a type of charity within an income group under several policy reforms to see if that sheds any more light on how the tax deduction is related to giving behavior.

This analysis does not take account the dynamic nature of income and giving. Recent works by Randolph (1995) and Auten et al (2002) allow for both permanent and transitory income and prices. They find that total giving is much more responsive to permanent income than to transitory income, and is more responsive to transitory price than to permanent price. Since I only examine two years of data, my analysis ignores the

⁴ This methodology implicitly assumes that donations to different types of charities are decided upon independently. If, on the other hand, individuals choose the total amount to give and then allocate that amount between various charities, the problems of seemingly unrelated regressions are relevant.

dynamic nature of giving behavior. I am more interested in comparisons across types of charities than in the actual magnitude of the estimates. As long as the permanent and transitory responses differ across charity categories in the same manner as my static responses, the omission of the dynamic aspect of the problem does not affect the results.

4. DATA ON GIVING DESCRIPTION AND STATISTICS

I utilize a module from the 2001 and 2003 PSID called the Center on Philanthropy Panel Study (COPPS). One possible concern is that the PSID over samples low-income households. This could be problematic if higher income individuals give to charity in a different manner than low-income households. Wilhelm (2002) compared this study to the 1974 National Study of Philanthropy, which over-sampled the rich, and determined that the two surveys found comparable results.

The PSID contains 16,621 pooled observations of families in 2001 and 2003. I exclude the self-employed and farmers (887 observations) as well as families where the head is older than 64 (2119 observations) leaving me with 13,615 observations. The self-employed and farmers face special tax rules, making it difficult to compute their marginal tax rates. Individuals over age 64 may have retired and have current income lower than their permanent income. Estimates of their income elasticity will be biased downwards if the giving behavior of these families does not decrease upon retirement.

Table 2.1 contains weighted descriptive statistics for the remaining sample of 13,615. Sixty-four percent of these families donate some amount of money to a charitable organization. Forty-three percent itemized deductions, and 30% itemized charitable contributions. Not all donors itemize. Only 57% of families who gave to a charity reported itemizing a charitable contribution on their tax return. For itemizers,

88% give to charity, while only 47% of non-itemizers donate. This suggests that itemization and the tax deductibility of donations play a role in giving decisions. The mean income is \$64,658. The first set of variables contains controls used in studies that utilize tax data: age of head, whether married, and number of kids. These are the only demographic variables in such data. One advantage of the PSID is that it has lots of other information. I include three additional demographic variables: education of head, male, and white. Next, I include dummy variables for religious affiliation. Ten percent report no religious affiliation, 34% are Protestant, 17% are Catholic, 2% are Jewish, and 37% report some other affiliation. The next variable, own, equals 1 if the family owns their home and 0 otherwise. Homeowners may have more attachment to their community, and may be more likely to donate to charitable organizations in the community. The final variable, emergency food, equals 1 if the family received emergency food in the last year. This is a proxy to control for families that may receive benefits from charitable organizations. I expect these families to be less likely to donate, on average, than otherwise similar families.

Another benefit of using the PSID is that it contains extensive income data for each family. This enables me to use the NBER's TAXSIM calculator to compute marginal tax rates for each family. As explained in the preceding section, I compute the marginal tax rate for the first dollar of contributions made to charity. In addition, each family is asked if they itemized deductions on their taxes. Earlier surveys do not contain this information, and researchers who used them have to determine itemization status using the available income data. The mean federal + state marginal tax rate is 22.3%, while the mean price is 0.88. For donors, the mean price is 0.83, while the mean price for

non-donors is 0.965. Conditional on itemizing, the mean price is 0.72. Since donors have a smaller price (larger tax rate) than non-donors, it seems that the price (tax rate) matters for donation decisions.

Table 2.2 shows the breakdown in giving by each category.⁵ The top panel contains nine rows categories that are included in both years of the survey. The five categories in the bottom panel contain information for 2003 only. Column 1 contains the mean contribution for each category conditional on giving to that specific type of organization for all donors, and column 2 represents the number of families giving to each category. The next three pairs of columns subdivide giving behavior into income groups. For nearly all categories, giving increases with income. Not surprisingly, 72% of donors report giving something to a religious organization. Outside of religion, the two most popular categories of charities are organizations that serve a combination of purposes (Combo) (i.e. United Way and Catholic Charities) and those that help the needy through food or shelter (Needy). The least popular categories seem to be those that improve neighborhoods and communities (Community), Environmental causes, and International Aid and World Peace agencies.

4.1 INDEX VALUES

I use results from existing literature to determine the index values for each category of charity. For most of the categories, I use results from a book edited by Charles Clotfelter entitled “Who Benefits from the Non-Profit Sector?” Each chapter in this book answers the title question for a different category including: health services,

⁵ For more information about what each category contains, see Appendix 2B.

education, religious organizations, social services, arts and culture, and foundations. The ‘who’ that benefits in the title refers to the income classification of the recipients.

In general, each index value is the percent of recipients or users of the charity with low income multiplied by the percent of income spent on recipients (as opposed to fundraising or administrative costs). Each index is between 0 and 1, where 1 means they give 100% of their funds or services to the poor, and 0 indicates that they give 100% to the non-poor. Appendix 2A describes exactly what information I use to calculate each value. Table 2.3 summarizes the calculated index values. The magnitudes are not important. Rather, what matters is the size of each category’s index relative to those of other categories. As expected, Arts have the smallest index value (.139), while the Social Services category has the largest index value (.498).⁶ Certainly, the reader may have their own perceptions about how well each category benefits the poor, and I do not claim that these values are the “best” measures. I present these results as one way to quantify the benefits, which is helpful later to compare the regression results across categories.

Table 2.2 provides evidence that income is correlated with giving. Taking into account the indices of Table 2.3, it also illustrates that some of the largest gifts, on average, are to groups that traditionally benefit the poor (Combo, Needy, Social Services). However, this information tells us nothing about how these donations are related to the tax deduction. It would be an easy mistake to say that the largest donations are to groups that help the poor, so people must be altruistic. What matters is how these donations change at the margin, while controlling for other variables. It may be the case

⁶ The Social Services category does not correlate directly with any one category of giving in the PSID. It is a combination of Needy, Youth, and Community. Thus, I create a giving category called Social Services = Needy + Youth + Community to use for the regression analyses.

that the rich have a larger income elasticity for giving to Needy than they do for Arts. If this is so, then I can call them altruistic. However, if the effect goes the other direction, it might be evidence of egoism.

5. ESTIMATION RESULTS

Table 2.4 contains results for estimates of (2.12) via Tobit where the dependent variable is the natural log of total donations. The reported results here and throughout this chapter are marginal effects conditional on $g_i > 0$. In column (1), I use only the additional variables that are dominant in the literature: age of head, married, number of kids, and a year dummy. This yields a price elasticity of -2.26 and an income elasticity of 0.627. In columns (2)-(5), I successively add in more groups of variables: demographics, religion, community attachment, and state fixed effects. In all specifications, standard errors are clustered by families. Notice that the addition of state fixed effects in column (5) does not affect the price and income elasticity estimates. Therefore, all further equations in this chapter omit the state fixed effects. All of the religious variables have a positive sign, indicating that religious families donate more than similar families with no religious affiliation. Homeowners give around 25% more than renters. Families that receive emergency food give 37% less than their counterparts, controlling for other variables. The price and income elasticities in column (4) [-1.75 and 0.46] differ slightly from the estimates in the literature [-1.3 and 0.7]. My estimates include more control variables, utilize more recent data, and contain information on non-itemizers.

Next I estimate the specification in column (4) for each category of giving. Refer to table 2.5 for the price and income elasticity estimates. Total giving is more elastic in

both price and income than indexed giving to the poor. The categories are presented in descending order of the index value. Thus, the social services category is listed first, since it has the highest index for helping the poor, and the arts are listed last with the lowest index value. The results by category in this table suggest giving is altruistic. At the margin, a 10% increase in income increases giving to groups that support the needy and groups that provide social services by 2%, while giving to health, education, and arts groups increase by 16%, 1.8%, and 1.05%. However, table 2.2 indicates that giving patterns vary with income. Thus, the estimates of the price and income elasticities may vary over income.

Table 2.6 compares the additions of price and income splines to the model for total giving. Column 1 contains the previous result with no splines. In column 2 I add a spline in income. The price elasticity does not change statistically. The income splines are all significant, and imply that donors in different income categories do have different income elasticities. Donors in the upper third of income are the least income elastic (0.125), followed by the poorest third (0.497) and then the middle third (0.760). Next I examine the effects of a price spline, with no spline in income. The new income elasticity (0.507) is not statistically different from the original income elasticity of 0.472. The price elasticities vary significantly. The poorest are the most price responsive (-3.11), and the richest third are the least (-1.525). Finally, I consider both a price and income spline in column 4. The price elasticities change, but only slightly. The income elasticity for the poor, however, is dramatically different from column 2, the wrong sign, and not statistically different from 0. Columns 3 and 4 indicate that donors in different income categories do exhibit different price responsiveness. The significant spline

income elasticities in column 2 with only one price variable are most likely picking up the effects of the different price elasticities. From here on, I use the specification in column 3 with a spline in price and no income spline.

In Table 2.7 I compare the price and income elasticities with a spline in price across the types of charities. As before, the largest income elasticities are for categories that benefit the poor: social services (0.237), needy (0.215), and combo purpose (0.305). First consider the price elasticity estimates for families in the upper third of income. Excluding the insignificant estimates, the smallest elasticities are for the charities that benefit themselves: environment (-0.26), arts (-0.11), education (-0.35), and health (-0.38). Meanwhile the price elasticity for giving to charities that benefit the needy is -0.575. Thus, the wealthiest tercile is not influenced by the tax in making donations to organizations that benefit themselves. They are, however, twice as price responsive when making donations that benefit others. Also of note, the income elasticity for donating to the arts is almost twice as large in absolute value as the education and health elasticities for donors in the bottom two income terciles. Taken together, this table implies that the tax deduction is likely to induce donors to give to organizations that they do not benefit from. Charities that the donor benefits from are much more inelastic than charities that benefit others.

The categories with more than 12,600 observations contain information for both years. The remaining 5 categories contain information for 2003 only. To test that giving behavior is not inherently different in 2003, I present Table 2.8 where the sample is restricted to 2003 for all categories. While the magnitudes differ slightly, the exact same patterns arise. Excluding needy and combo purpose organizations, the top and bottom

terciles are still more price elastic for categories that tend to benefit others, while the middle income tercile may be altruistic. In Table 2.9, I exploit the panel nature of the data and estimate a random effect Tobit for the categories that contain information in both years. Once again, the magnitudes change slightly, but the patterns remain the same. Taken together, all of the results indicate that both the poor and the rich are more price and income elastic when donating to charities that benefit others. Charities that benefit themselves are more price inelastic. Thus, the tax deduction should encourage each group to give more to groups that benefit others. With respect to the tax, both groups appear to be altruistic.

6. POLICY SIMULATIONS

The previous sections results demonstrate that donations are responsive to the tax price, that the price elasticity differs by type of charity, and that this elasticity is non-linear in income. In this section I use the elasticity estimates to simulate what happens to aggregate donations and tax revenue under reform. While similar analyses are performed by Feldstein and Taylor (1976) they use tax return data. Consequently, they must make assumptions about the donations of non-itemizers, and the price elasticity's are computed using only data for itemizers. This could be problematic if non-itemizers react to the tax differently from itemizers. My estimation includes both itemizers and non-itemizers and will not have this problem.

To approximate the effects of each reform, I use the price elasticity (\mathbf{e}). Note that $\mathbf{e} = \frac{\% \Delta g_i}{\% \Delta P_i} = \frac{\Delta \ln g_i}{\Delta \ln P_i}$ implies that $\Delta \ln g_i = \mathbf{e} \cdot \Delta \ln P_i$. Let P_i' denote the price

elasticity under reform and g_i' the simulated (predicted) donation. Then the predicted level of giving under reform can be computed as:⁷

$$g_i' = \exp(e \cdot (\ln P_i' - \ln P_i) + \ln g_i) \quad (2.14)$$

This approach assumes that the other covariates do not change under the proposed reform. Demographic variables like age, education, race, and number of children clearly do not change. After tax income does change, but this is not a problem since I use pre-tax income in my estimates.

I consider three major reforms of the current system: eliminate the deduction, extend the deduction to non-itemizers, and allow a 20% tax credit for all donations capped at the federal tax liability. Table 2.10 contains aggregate changes in total giving and tax revenue based on 2003 data. Columns 1 and 2 contain total donations and tax payments under the current law where only itemizers can deduct charitable donations. Using data from 2002, tax payments total \$937 billion. For comparison, the IRS reports that they received \$ 797 billion from income taxes in 2002. I attribute the difference to the fact that my tax calculations do not include all of the possible expenses an individual can itemize. While I have data on itemized medical expenditures and charitable contributions, I do not know anything about mortgage interest payments or other itemized expenses. Thus, I underestimate itemization, and overstate tax payments. This is not a problem, however, since I am interested in the *change* in tax payments under each reform. None of the reforms cause itemization of the other expenses to change, so the overall changes will remain the same.

⁷ A more precise approach would use all of the Tobit estimates to predict the conditional value of giving. I've done this as well and the results are equivalent.

Total current giving in 2002, \$156 billion, differs slightly from the AAFRC Trust for Philanthropy estimate of \$184 billion. As explained by Wilhelm (2002), this is likely due to the different way the measures are created. The COPPS data come from asking individuals how much they donate, while the AAFRC measures giving by itemizers from tax returns, and estimates giving by non-itemizers from the COPPS survey.

For the first policy reform, consider what happens when the deduction for charitable contributions is eliminated. This policy changes the price of giving to 1 for all taxpayers, and only affects the giving behavior of itemizers. Columns 2 and 3 show that total donations decline by \$47 billion (30%) under this policy, while tax revenues increase by \$15 billion (10%). Or, in the reverse, allowing itemizers to deduct charitable gifts creates an additional \$47 billion in donations at a cost of \$15 billion in tax revenue.

The next policy reform extends the deduction to non-itemizers. Under this policy, the price of giving for non-itemizers falls to $1-t$. Columns 5 and 6 imply that total giving under this policy increases by \$22 billion, while tax payments fall by \$4 billion. This reform only affects tax payers who do not itemize under current law. Thus, it is no surprise that the largest percent increases in giving, around 20%, come from taxpayers in the bottom two income groups, while taxpayers in the richest tercile increase giving by 10%.

Next, I consider eliminating the deduction and allowing all donors to receive a 20% tax credit that cannot exceed the tax liability before the credit. A tax credit changes the price of giving to $1-0.2$ for all donors that receive the credit. For all non-itemizers, this new price of giving is smaller than the current price. This is also true for itemizers in the bottom two income groups. The model predicts that these taxpayers have large

increases in giving under a tax credit. Those in the middle tercile increase giving by \$11 billion (30%) and the poorest tercile gives \$17 billion more (90%). Itemizers in the richest tercile decrease giving under a tax credit because the new price of giving is larger than their current price. Specifically, they decrease giving by \$12.6 billion, or 13%. With a 20% tax credit total giving increases by \$15.8 billion, and tax revenue falls by \$16.8 billion.

The largest overall increase in giving with the smallest decrease in tax revenue comes from allowing extending the deduction to non-itemizers. The 20% tax credit is smaller than the average marginal tax rate of the richest tax payers, so those donors actually decrease giving with the tax credit. Any tax credit must be larger than the average marginal tax rate of the rich (26.3%) in order to increase donations more than simply allowing everyone to deduct charitable donations. However, a credit that large will also cause tax revenue to fall even more than under a 20% tax credit. Thus, the least costly reform is to allow everyone to deduct donations.

Table 2.10 illustrates how total giving changes with each reform. The empirical results imply that each type of charity exhibits a different level of price responsiveness. Thus, it is not implausible that giving to each type of charity reacts differently to the reforms. Table 2.11 contains the percent change in giving for each type of category under the three tax reforms. The first row contains the percent change in total giving determined in the previous table. The last row, 'total gifts', differs from the first because it is computed by adding up the predicted donations for each category, and then computing the percentage change. This change of 17.7% is smaller than the change in gifts found from using the elasticity of giving to any charity.

If all donations are equally responsive, then the percent changes in column 1 for each type of charity should all equal 17.7%. A quick glance indicates that this is not the case. Eliminating the deduction causes religious donations to fall by 21%, gifts to needy and combo to fall by 15%, gifts to health and education to fall by 10%, and gifts to the arts to fall by 4%. Interestingly, categories with the highest index values, or propensity to benefit the poor, experience the largest percentage declines in giving when the tax changes. This indicates that the deduction does, at least, induce itemizers to give more to organizations that benefit the poor than to others.

A similar pattern arises when the deduction is extended to non-itemizers. Total giving increases by 7%, as does giving to religious, needy, and combo purpose organizations. All others increase by smaller amounts (around 3-5%). These patterns do not exactly hold across different income groups. Since the first reform only affects itemizers, the richest tercile experiences much larger percent changes in giving than the other 2 groups. Likewise, since allowing all to deduct only affect non-itemizers, the largest changes are in the bottom two income groups.

Implementing a 20% tax credit produces varying results. Total donations to health, education, and community groups all decrease, presumably because the bulk of those donations come from the highest earners. The wealthiest taxpayers decrease giving to all categories, with the largest decrease going to religious, needy, and combo purpose organizations.

All together table 2.11 illustrates that donations to specific categories do not react to tax changes equally. Furthermore, the first panel provides evidence that the current

deduction causes larger increases in giving to groups that benefit the poor than to other types of charities. This result holds across all income categories.

Next, I look at expenditure shares. Religious donations comprise around 65-70% of total donations for all income groups. Table 2.12 looks at the percent of giving to non-religious charities. Under current law, 55% of non-religious donations go to organizations that provide services to the needy or serve a combo purpose. The next 24% go to health and education, while the arts receive 3.6%. Eliminating the deduction causes the share of donations going to needy and combo to fall slightly, around 1 percentage point, while the other shares each increase by about .03%. Thus, allowing itemizers to deduct contributions causes them to redistribute their giving (slightly) in favor of organizations that benefit the poor. This table implies that the richest households are altruists, and the poorest households are egoists. The largest non-religious donation shares for both income groups are to groups that benefit the needy or serve a combination of purposes. The rich give the most to groups that benefit others (altruism), while the poor give the most to charities that benefit themselves (egoism).

To determine if an income group gives disproportionately to a particular type of charity, compare the expenditure share for the given income group to the overall expenditure share for that type of charity. For the most part, the expenditure shares across income groups are constant. With no deduction, gifts to education make up 13% of total donations, and 15% of donations by the rich. Only 6% of donations from the poor go to education. Thus, the rich give a much larger proportion of their charitable contributions to education than the poor. Another category with consistent differences is environment. The overall expenditure share is 2.7%, however the poorest households

only give 1.9% and the middle households give 3.4% of their total non-religious donations to the environment.

Finally, I examine the distribution of giving to a type of charity by income. The first row of Table 2.13 contains the distribution of after tax income across income categories. The poorest third receive 11.4% of net income, the middle third receive 24.8%, and the richest third receive 63.8%. I compare this income distribution to distributions of giving across the three income groups. If the distribution of giving is the same as the distribution of income, then all income groups donate proportional amounts. If the percent of donations to a type of charity for a given income group is greater (smaller) than that income groups share of total income, then that income group gives disproportionately more (less) than the other income groups. The distribution of total giving is exactly the same as the distribution of net income, and the distributions of giving to religious, needy, combo, and health are all close to the income distribution. Education and arts groups both exhibit stark departures from the income distribution. While the richest income tercile has 64% of after tax income, they make 71% of donations to the arts, and 77% of donations to education charities. The poor give more than their share of the income distribution to international charities, while the middle income group gives disproportionately more to community groups, charities that provide youth and family services, and the environmental charities. Interestingly, with no deduction the richest taxpayers provide 63% of total donations to the needy. When itemizers can deduct donations, this share rises to 66%. With a tax credit the proportion of donations to the needy by the rich falls to 60.6%. This table, along with the previous

2, provides evidence that the current law encourages donors to give more charities that benefit the poor.

7. CONCLUDING REMARKS

My results indicate that donations to different types of charities do not exhibit the same price and income elasticities, and that the price elasticities are not constant across income. Specifically, I find evidence of altruism for the richest taxpayers and egoism for the poorest taxpayers. Donations by high income individuals to charities that benefit the poor are more price elastic than donations to charities that benefit themselves. Likewise, the most price elastic categories for low income individuals are charities that they use or benefit from.

I use the price elasticity estimates to simulate total giving to each type of charity under various tax reforms, I find evidence that the current tax deduction induces itemizers to donate more to charities that benefit the poor than they would have given without the deduction. Allowing itemizers to deduct contributions causes them to redistribute their giving (slightly) in favor of organizations that benefit the poor. The largest non-religious donation shares for both income groups are to groups that benefit the poor. The rich give the largest percent of non-religious donations to groups that benefit others (altruism), while the poor give the most to charities that benefit themselves (egoism).

CHAPTER 3. TOBACCO TAX INCIDENCE

1. INTRODUCTION

In 1864, the federal government implemented the first excise tax on tobacco at a rate of 0.8 cents per pack of 20 cigarettes. The federal rate grew to 39 cents per pack in 2005. States levy their own tobacco taxes on top of the federal rates. Excise taxes on cigarettes can provide a significant source of revenue for governments, in large part due to the addictive nature and hence relatively inelastic demand for tobacco products. Many states justify these taxes as a correction for an externality caused by the detrimental effects of second-hand smoke, and to compensate the states for the high cost of state-funded health care for smokers. Some simply acknowledge that taxes on tobacco are a good deterrent to prevent potential smokers from ever forming the habit.

Aside from the justification, it is important to know who actually pays the tax. If the tax is entirely passed on to the consumers, the literature on cigarette demand tells us that smoker participation will fall – especially amongst the most price sensitive, teenagers.¹ Studies that estimate demand generally use the excise tax as a proxy for the price of cigarettes, and then assume that the price and tax have a one-to-one relationship. If this is not the case, projections of smoking cessation from a tax change based on these studies may be incorrect. Several studies have shown that the tobacco industry may be imperfectly competitive, which may allow the firms to increase prices by more than a tax. Thus, it is important to understand how this tax affects the final retail price of cigarettes.

¹ Chaloupka (1991), Becker and Murphy (1998), and Evans et al (1999) all estimate short run price elasticities of approximately -0.3 to -0.4 for the general population, and -0.8 to -1.0 for teenagers.

This analysis seeks to determine the incidence of tobacco excise taxes, and it fills in several gaps in the existing literature. First, I use more current data than any other study of tobacco tax incidence, and I find evidence that the ability of manufacturers to overshift the tax onto consumers has fallen over time. Second, I control for potential border crossing, or “bootlegging” across states to avoid paying higher taxes. Third, this is the first study of the tobacco tax incidence to allow for a dynamic specification. This specification indicates that the tax is undershifted in the short-run and over-shifted in the long-run.

The remainder of the chapter proceeds as follows. Section 2 analyzes the relationship between market structure and tax incidence. In section 3, I discuss previous estimates of tax incidence in the tobacco industry. The underlying theoretical framework and empirical specification is described in section 4. Next, the fifth section describes the data on tobacco prices and taxes for each state from 1954-2005, available from the Tobacco Institute (1989) and the Centers for Disease Control. Estimation results are presented and discussed in Section 6. Finally, Section 7 concludes.

2. MARKET STRUCTURE AND THE RELATIONSHIP WITH TAX INCIDENCE

To determine the economic incidence of the tobacco tax, it is first important to understand the statutory incidence. Tobacco manufacturers pay the federal excise tax and sell their products to distributors. All distributors must obtain a license to operate in a particular state, where they are then required to pay the state excise tax. Thus, manufacturers may be able to price discriminate based on the level of the state tax. Sumner (1981) shows that distributors cannot arbitrage between these prices. Finally, distributors sell their product to various retail outlets, where consumers purchase the

tobacco. The final retail price can include markups at all three levels of the chain. In addition, states levy sales taxes on tobacco products. This analysis, however, is solely concerned with the incidence of the excise taxes, and sales taxes are ignored.

The purpose of this analysis is not to determine the structure of the tobacco industry. However, the existing market structure may imply something about the incidence of the tax. I consider three cases.

Case 1: Perfect Competition

First consider the extreme of perfect competition. A profit-maximizing perfectly competitive firm faces a given price p and chooses quantity q to maximize profits:

$$\max_q pq - c(q) - tq$$

where $c(q)$ is the cost function, and t is the unit excise tax on tobacco products. At the optimum $p = c' + t$, which says that price is set equal to marginal cost plus the tax rate. Thus, an increase in the excise tax has the same impact on price as a change in marginal cost. This is depicted graphically in Figure 3.1. Under perfect competition, the following relationship always holds: $\Delta p = \Delta t$.

Case 2: Oligopoly

Let each firm i acting in an oligopoly maximize profit according to:

$$\max_{q_i} p(Q)q_i - c(q_i) - tq_i,$$

where $Q = \sum_i q_i$ represents industry wide output, and $p(Q)$ represents the inverse demand function. Then, the first order condition states that $p'q + p - c' - t = 0$, and the second order conditions require that $p''q + 2p' - c' < 0$. Fullerton and Metcalf (2002) show that

$$\frac{dp}{dt} = \frac{N}{N + \mathbf{h} + k}. \quad (3.1)$$

for $\mathbf{h} \equiv Q \frac{p''}{p'}$ and $k \equiv 1 - \frac{c''}{p'}$. The relationship between price and tax is dependent on the number of firms (N), the elasticity of the slope of the inverse demand function (\mathbf{h}), and the ratio of the slopes of the marginal cost and inverse demand functions (k). Then, $\frac{dp}{dt} > 1$ requires that $\mathbf{h} + k < 0$. Thus, for certain functional forms of demand and marginal cost, oligopolists can have either $\Delta p \geq \Delta t$, or $\Delta p \leq \Delta t$.

Case 3: Monopoly

Finally consider the other extreme of pure monopoly. A monopolist can overshift or undershift, depending on the shape of the demand curve. To see this, note that the price and tax relationship in equation (3.1) applies to monopolists when N is 1. Then, $\frac{dp}{dt} > 1$ requires that $-1 < \mathbf{h} + k < 0$. With a linear demand curve, $\mathbf{h} = 0$, the monopolist always undershifts the tax, as shown in the first part of Figure 3.2. Conversely, if the demand function exhibits constant elasticity, the monopolist always overshifts as depicted in the lower part of Figure 3.2. Thus, the specification of the demand function dictates the tax incidence for a monopolist.

As summarized in Table 3.1, determining the relationship between price and tax can tell us something about the market structure. Evidence of market power exists whenever price and tax do not exhibit a one-to-one relationship. While perfect competition implies that $\Delta p = \Delta t$, observing a one-to-one relationship does not imply perfect competition.

In 1998, 46 states and the four largest tobacco manufacturing firms signed what is known as the Master Settlement Agreement (MSA). The agreement exempted the tobacco manufacturers from all further lawsuits. In return, the four firms agreed to numerous restrictions on their advertising and to pay the states billions of dollars each year for perpetuity. Each firm pays their 1997 market share of a predetermined amount for each year.² However, “volume adjustments” allow the payments to increase when industry sales go up, or to decrease when overall consumption falls. Note that the payments are dependent on industry sales. This means that a particular firm will experience an increase in payments only if overall sales increase. The following is an oversimplification, but it illustrates the nature of the adjustments:

$$Payment_{it} = \left(\frac{Volume_t}{Volume_{1997}} \right) \times share_{i1997} \times Amount_t. \quad (3.2)$$

In year t , for the 4 firms in the settlement, each firm i must pay its share of the market in 1997 ($share_{i1997}$) multiplied by the predetermined total dollar amount for year t ($Amount_t$), and adjusted by the ratio of the actual industry-wide sales volume in year t ($Volume_t$) to the sales volume in 1997 ($Volume_{1997}$). Let

$f_{it} = Amount_t \times \left(\frac{Share_{i1997}}{Volume_{1997}} \right)$ represent the factors that firm i cannot change in year t .

Then, $Payment_{it} = f_{it} Volume_t = f_{it} Q_t = f_{it} \sum q_{it}$. Suppose industry sales increase by 100 units in year t , and that all of this increase is done by firm j with $share_{j1997} = 60\%$. Then,

² The four tobacco manufacturers and their 1997 market shares are Philip Morris (69%), Brown and Williamson (17.9%), Lorillard (7.3%), and RJ Reynolds (6.8%).

$Payment_{jt} = 100 \times 0.6 \times Amount_t$. The firm only experiences a payment increase based on its 1997 market share, even if it sold all of the extra cigarettes. Thus, the MSA annual payments behave like a unit excise tax and all of the previous analyses apply to the MSA payments as well.

3. PREVIOUS ESTIMATES OF TAX INCIDENCE AND ANTI-COMPETITIVE BEHAVIOR

Much of the research concerning excise taxes on tobacco and cigarettes concentrates on the effect the taxes have on consumer demand and on firm behavior. Few studies attempt to determine the economic incidence of the tax.³ They may do so indirectly, but this is not the question with which they begin. Table 3.2 contains a brief overview of this literature.

Barzel (1976) theorizes that a unit tax on *any* good causes an increase in the final price by an amount greater than the initial tax, regardless of the underlying market structure. He argues that taxation induces firms to increase the quality of the taxed good, resulting in increased prices. Using tobacco data, he tests this theory and finds that the retail price of tobacco increases by an amount greater than the tax. In particular, he finds that the increase is equal to the tax rate times 1.065, and that this estimate is significantly different from 1. Barzel finds it difficult to tell if the resulting price increase is a tax burden on consumers, or if it merely reflects a change in quality.

Johnson (1978) notes that Barzel does not control for state fixed effects, which implicitly assumes that tax rate differences cause all of the price variation between states.

³ I am concerned with the sharing of the incidence between consumers and producers. Many studies do examine the distributional incidence of the tax across consumers, including Gruber and Koszegi (2004) and Lyon and Schwab (1995).

However, Johnson claims, considerable variation exists across states in the price net of the tax, largely as a result of differences in local distribution costs. Once state fixed effects are included in the model, the coefficient on tax increases to 1.101.

The tobacco industry may not have been the best industry for Barzel to test his theories, as many economists believe this industry exhibits evidence of market power. Temnant (1971), Tollison and Wagner (1988) and Bulow & Klemperer (1998) each note evidence of collusion on price by cigarette manufacturers. In the Tobacco Case of 1946, the government convicted tobacco manufacturers of operating an illegal cartel in the 1930's. According to Harris (1987), the "consensus has been that company behavior was not changed by the verdict" (p. 99). Harris presents data on price changes by the six major firms in the early 1980's and makes an argument for price collusion. He goes so far as to assert that the price increase after the 1983 federal excise tax increase was not caused by the tax change. Instead, the tax increase allowed the six firms to raise prices while allowing consumers to believe that the increases were due to the higher tax. The assertion that is that prices rose by amounts greater than the tax during this period, while costs did not experience the same increases.

Sumner (1981) and Sullivan (1985) each try to estimate market power in the tobacco industry. Since data on marginal costs are not readily available, they instead use price and tax data to determine the markup over the tax. Any estimated relationship not equal to 1 rules out perfect competition, while a one-to-one relationship could occur under either perfect or imperfect competition.

Sumner begins with the usual equilibrium pricing condition that marginal revenue equals marginal cost, or $P_j = \frac{h_j}{1+h_j} MC_j$, where h_j is the elasticity of the firm level demand for firm j , p_j is price, and MC_j represents marginal cost. Because unit excise taxes increase marginal costs linearly, Sumner uses the tax rates as a proxy for the unobserved marginal cost to estimate the shifting parameter. Using panel data over states and years, Sumner regresses retail price on the tax in each state and controls for state and year fixed effects. He finds that a 10 cent tax raises retail price by 10.74 cents, which implies a firm level demand elasticity of -13.5. Since firms in a perfectly competitive market experience a firm level demand elasticity equal to $-\infty$, he claims that this result provides evidence of market power. At the time, Sumner's paper was cited as an "ingenious"⁴ approach to determining market power in the absence of marginal cost data, and it is widely recognized as developing the methodology for determining tax burden under imperfect competition.⁵ However, Bulow and Pfleiderer (1983) demonstrate that the results are sensitive to a restrictive assumption about the functional form of demand. Specifically, the firm-level demand must exhibit constant elasticity in order for the firms to pass on a constant fraction of cost in the price, and constant elasticity demand implies overshifting.

Sullivan (1985) generalizes Sumner's procedure to work for any functional form of demand by estimating a model of conjectural variations. His estimates indicate that a 10 cent tax increase causes price to go up by 10.89 cents. Using this result, Sullivan determines that the industry behaves as if it contains 2.55 firms (or cartels acting as

⁴ See Bulow and Pfleiderer (1983) page 182.

firms). With six major tobacco companies in existence at that time, Sullivan claims that this finding indicates some level of collusion among those firms.

Evans, Ringel, and Stech (1999) also estimate the amount of a cigarette tax passed on to consumers. Using data from 1985-1996, they regress price on tax, controlling for both state and year. They find that the tax is shifted onto consumers by 1.01 in nominal terms, and by 0.92 in real dollars. Unlike the earlier studies, they find near perfect competition. However, they note that the coefficient on the tax rate in nominal dollars becomes 1.13 when using data from 1971-1996. Perhaps the market power that once seemed prevalent in the tobacco industry has diminished over time. If so, the ability of the manufacturers to pass the tax on to consumers has diminished as well. This analysis uses data that is even more recent, so it will be of interest to see if the overshifting of the tax to consumers falls even more.

Barnett et al (1995) use data from 1955 to 1990 to estimate incidence using a three stage least squares conjectural variation model of the cigarette industry. They simulate the effects of state and federal excise taxes separately and find that federal taxes cause much larger increases in price than state taxes, likely because state taxes can be more easily avoided by border crossing and smuggling. Keeler et al (1996) control for border crossing and anti-smoking legislation using data from 1960-1990 and find that a 10 cent tax increase causes price to rise by 11.1 cents.

Delipalla & O'Donnell (2001) utilize data on cigarette taxes in 12 European countries to estimate market power and tax incidence in the cigarette industry. These nations impose both unit excise taxes and *ad valorem* taxes on cigarettes. They find

⁵ See Besley and Rosen (1999) and Porterba (1996).

evidence of undershifting for both types of taxes in some countries, and that the unit tax always has a greater effect on price than the *ad valorem* taxes.⁶

Taken together, these studies do find evidence of overshifting of the tax, and consequently, of market power in the tobacco industry. Interestingly, studies that use data from more recent years find coefficients closer to one. The most current uses data only up until 1995, and only Keeler et al (1996) control for possible border crossing activity. None of them include data from after the Master Settlement Agreement in 1998, which Bulow and Klemperer (1998) note spurred manufactures to increase prices rapidly early that year in an attempt to offset the future payouts required by the settlement. In addition, the payments required by the MSA have the same effect on pricing as a federal excise tax. My analysis fills in these gaps in the literature by using data from 1954-2005 and by controlling for border crossing activity. I also take into account the dynamic relationship between price and tax to compute both short-run and long-run effects.

4. THEORETICAL FRAMEWORK AND EMPIRICAL SPECIFICATION

I present a very simple model to help motivate the econometrics. This “model” is based on the framework used by Besley and Rosen in their 1999 examination of sales tax incidence, with appropriate adjustments for a unit tax. Consider a tobacco firm operating in state j at time t . The firm can be thought of as the combination of manufacturers,

⁶ These results are not directly applicable to the tax treatment of tobacco in the US for several reasons. First, taxes are required by the European Union to be greater than or equal to 70% of the price, while taxes comprise around 30% of the price in the U.S. Second, in about half of the included countries, the government maintains control of domestic production of cigarettes. Certainly, an industry under government control will price differently than private manufacturers who are thought to collude.

distributors, and retailers that together set the final consumer price. Assume that the tobacco firm maximizes profits through its choice of quantity q_{jt} .

Profit is represented by the difference between revenues $R^{jt}(q_{jt}; z_{jt})$ and costs $C^{jt}(q_{jt}; z_{jt}, \mathbf{t}_{jt})$, where z_{jt} represents the behavior of other firms in the market, and \mathbf{t}_{jt} is the unit tax rate on tobacco products (in state j at time t). Assume that the firms make choices to form a Nash equilibrium with equilibrium values (z_{jt}^*, q_{jt}^*) where $z_{jt}^* = z_{jt}(\mathbf{t}_{jt})$ and $q_{jt}^* = q_{jt}(\mathbf{t}_{jt})$. Thus the choice of output, and hence price, is a function of the tax.

The solution to this problem can be expressed as:

$$p_{jt} = \mathbf{f}_{jt} \cdot (m_{jt} + \mathbf{t}_{jt}) \quad (3.3)$$

where

p_{jt} = tax-inclusive price of tobacco in state j at time t ,

\mathbf{f}_{jt} = mark-up on tobacco in state j at time t , and

m_{jt} = marginal production cost of tobacco in state j at time t .

This formula says that price is equal to a mark-up over marginal cost.⁷ In a perfectly competitive industry, the mark-up factor is equal to 1, and price equals marginal cost plus the tax. Furthermore, the mark-up parameter \mathbf{f}_{jt} and possibly the marginal cost m_{jt} are also functions of the tax. Equation (3.3) can then be written as:

$$p^{jt} = f^{jt}(\mathbf{t}_{jt}, \mathbf{q}_{jt}) \quad (3.4)$$

⁷ I am not using the mark-up parameter to estimate anything about the market structure. Instead, I am interested in the shifting of the tax between manufacturers and consumers. While this method has been criticized as relying on constant elasticity demand, I am not using the results to infer a market elasticity.

where \mathbf{q}_{jt} represents a vector of factors that affect the underlying cost of production or distribution, which typically vary across location and over time. According to Sumner (1981), prices vary little across brands within each market, indicating that the marginal cost of producing tobacco is likely the same across manufacturers. In addition, domestic tobacco is largely produced with a single technology in three states (KY, NC, and VA). Thus, the marginal production cost in this story can be interpreted as the cost of physically moving the tobacco product from a distributor to a retail outlet. Keeler et al (1996) proxy for this cost with a measure of the distance of each state from the tobacco producing region. Most others, however, simply use state and year fixed effects to capture these costs.⁸ With this in mind, cost variables are not used in this analysis. Given all of these assumptions, which eliminate the need for cost controls, the regression equation becomes:

$$p_{jt} = \mathbf{b}\mathbf{t}_{jt} + \mathbf{g}STATE_j + \mathbf{d}YEAR_t + \mathbf{e}_{jt} \quad (3.5)$$

where $STATE_j$ and $YEAR_t$ represent fixed effects for state and year, respectively, and \mathbf{e}_{jt} accounts for any unobserved effects on price. I assume that $E(\mathbf{e}_{jt}|\mathbf{t}_{jt}) = 0$, and that the error term is normally distributed. The state fixed effects reflect variations in local distribution costs, and the year effects capture changes in the macroeconomic environment that are assumed to affect costs in every state the same way. Federal excise tax changes are subsumed by the year effects.

The important parameter in this equation is \mathbf{b} . If the excise tax is fully passed on to consumers, it should be equal to 1. Any value of \mathbf{b} that is not equal to 1 provides

⁸ For example, see Johnson (1978) or Evans et al (1999).

evidence of imperfect competition. A value less than 1 indicates that the tax is shared between consumers and producers (undershifting). Similarly, b greater than 1 implies overshifting, assuming that price and tax have the same relationship in every state. This last assumption may be too restrictive, and so possible ways of relaxing this assumption are discussed later in the chapter. In addition, some form of market dynamics may influence prices. Firms do not necessarily respond to changes instantaneously. It takes time to enter or exit a market, and to change capacity choices. For this reason, a dynamic version of the basic equation is also estimated.

5. DESCRIPTION OF DATA

Price and tax data for every state from 1954 to 1988 are obtained from *The Tax Burden on Tobacco*, published by the Tobacco Institute (1988). For the years 1989 to 2005, the data are obtained from the Center for Disease Control website, which contains the information from the Tobacco Institute,⁹ for a total of 2,652 observations.¹⁰ Price is defined as the weighted-average price per pack. The Institute uses weights for length of cigarette (regular, king, 100mm) and for type of transaction (carton, single pack, machine). Wholesalers from around the country provide the institute with estimates of the average retail price in their area for each type of cigarette and type of sale. The institute then turns these numbers into state averages for each year. According to the institute, cigarette sales account for roughly 98% of tax collections on tobacco, which implies that data on cigarette taxes are representative of the entire tobacco market. The

⁹ See <http://apps.nccd.cdc.gov/StateSystem/index.aspx>

¹⁰ Note that data from Hawaii and Alaska are only available from 1960-2005.

tax variable includes both state and federal taxes, but does not include any city-level tobacco tax. Data from the CPI are used to convert all variables into real 2005 dollars.¹¹

Figure 3.3 depicts the history of the United States federal excise tax rate on tobacco products. The nominal federal tax rate shows no change for thirty years from 1954 to 1983, remaining at a constant 8 cents per pack. After the 1983 increase to 16 cents, the rate changes 4 more times: to 20 cents in 1991, to 24 cents in 1993, to 34 cents in 2000, and finally to 39 cents in 2002. This tax rate does not provide much variation for econometric purposes. Fortunately, the figure indicates that average state excise tax rates change more frequently.

Figures 3.4 and 3.5 illustrate the spatial distribution of average prices and tax rates over the entire sample, 1954-2005, measured in real 2005 dollars. States in the tobacco producing region have both the lowest prices and the lowest tax rates, while the largest prices and taxes occur in the northeast and north central states. The distributions of price and tax across the states are nearly identical. Thus, most of the variation in retail prices is due to the differences in excise taxes across states. In 2005, the most recent year available, the average retail price of cigarettes varied from \$3.15 in South Carolina to \$5.64 in the state of Rhode Island. Not surprisingly, the largest state tax rate in 2005 (\$2.46 / pack) occurs in Rhode Island, and the smallest state tax rate (\$0.07 / pack) occurs in South Carolina.

This analysis is concerned with the relationship between retail price and the tax rate. Figure 3.6 plots the mean price and tax rates in cents, for each year in the sample, in real dollars. Until the 1980's the price reflects changes in the tax rate almost one for one.

¹¹ CPI data are obtained from <http://www.bls.gov/bls/inflation.htm>.

After this period, the price rises by amounts greater than the tax. The class action law suits against the tobacco manufacturers began in 1996 coinciding with the start of the upward tick in price. In 1998, the tobacco manufacturers signed the Master Settlement Agreement and began to increase their prices in anticipation of the large future payouts they would have to make to the states. Furthermore, as shown in section 2 these payments act as a federal excise tax on tobacco. Real tax rates remains nearly constant for the first twenty years of the data. During the late 1980's and early 1990's the tax rate again remains constant, while the real price increases rapidly. The average excise tax in 1954 was 80.6 cents. By 1999 in real terms, this value was only 76 cents. Over the next 5 years a series of both federal and state tax increases increased the average tax to 131 cents per pack.

6. ESTIMATION AND RESULTS

The first row of Table 3.3 contains the results from estimating equation (3.5) for both nominal and real values. Since the panel is unbalanced (Hawaii and Alaska do not enter the dataset until 1960), standard errors are heteroskedasticity consistent. Nominal values are used in column (1), since states change nominal tax rates, and real 2005 dollars are used in column (2) to make comparisons over time. For the entire 1954-2005 sample, the estimates imply that a 10 cent tax increase causes price to rise by nearly 12 cents. The nominal and real estimates are not statistically different from each other.

Evans et al. (1999) note that the ability of tobacco firms to pass the tax onto consumers may diminish over time. From Figure 3.6, the one-to-one relationship between price and tax appears to change during the 1980's. With this in mind, the model is estimated omitting the first 5 years, the first 10 years, the first 15 years, and so on until

2001-2005. The coefficient on tax decreases as older years are omitted, and conversely increases as earlier years enter the sample. The coefficient is significantly greater than 1 for all but the 1996-2005 and 2001-2005 samples. While its lowest value, 1.004 for 2001-2005, still indicates the tax is shifted fully onto consumers, it seems that the ability to overshift disappears over time. To test this, I estimate equation (3.5) for mutually exclusive sets of years. Panel B of Table 3.3 contains the results of this exercise.

The 1954-1965 and 1966-1975 samples show evidence of overshifting, with coefficients in the real dollars estimation of 1.117 and 1.127, respectively. Becker et al (1994) claim that producers increase prices when taxes go up in order to obtain more profit from current smokers and offset losses from an expected decline in future smoking participation. This behavior is consistent with a monopolist facing constant elasticity demand, or an oligopolist with appropriate restrictions on the cost and demand functions. Conversely, when few nominal tax changes are legislated, and the real value of the tax falls, manufacturers may share some of the tax burden with consumers in order to increase levels of smoking participation. The tax is undershifted, with a coefficient of 0.803, between 1976 and 1983 when nominal taxes are fairly constant and real taxes fall. Also, from section 2, undershifting is consistent behavior for a monopolist facing a linear demand function. The largest amount of overshifting occurs between 1986 and 1995, when a 10 cent tax increases is predicted to increase price by 12 cents. This period is when many states began to increase tax rates rapidly. Finally, the last decade has a coefficient greater than 1, but it is not significantly different from 1. Many state tax increases occur in the late 1990's, but they are often paired with other measures of tobacco control like indoor smoking bans. Also, tobacco lawsuits and the federal tobacco

settlement in 1998 enabled the government to extract billions of dollars of revenue from the tobacco companies, with the first payments occurring in 2001. In addition, it was hoped that the tobacco companies would have to raise their prices to finance the settlements. Thus, while the statutory tax does not fully explain the large price increases in the last years of the sample, the total effective tax including the settlement payments may do so.

Next, I perform a series of robustness checks and tests to compare my results to earlier estimates. Table 3.4 contains these results. Delipalla and O'Donnell (2001) show that unit taxes have a larger impact on prices than *ad valorem* taxes. In my data, two states levy *ad valorem* taxes: HI and NJ. Omitting NJ from the sample does cause the coefficient on tax to increase, though not by a significant amount. Dropping Hawaii, however, actually yields a smaller coefficient. This is probably because Hawaiian residents have little opportunity for border crossing activity. Dropping either or both of these states causes a small enough difference from the baseline estimates that I am not concerned about any bias that their inclusion may cause.

The relationship between price and tax may be very different in the three tobacco producing states (KY, NC, VA) than in the other 47 states and the District of Columbia. Since these three states have some of the lowest tax rates and highest smoker participation rates in the nation, it seems fair to believe that some other factors influence the relationship between price and tax. When I estimate equation 3.3 without KY, NC, and VA, however, I obtain nearly identical results. Thus the inclusion of the tobacco producing states does not bias the results presented in Table 3.3.

Next, I split the tax variable into two separate variables as in Barnett et al (1995): one variable for the federal tax and one variable for the state tax. In the base results, the effect of the federal tax is contained within the year dummies. By design, the effect of the state tax remains unchanged.¹² I find that the federal tax has a much larger impact on price, with a coefficient of 3.00 when using real dollars. This means a 10 cent increase in the federal tax increases price by 30 cents (based only on time series variation). Manufacturers may be much more able to increase price when the federal tax changes because consumers are less able to avoid the tax through border crossing activities. In the next sub-section I control for state level border crossing.

Finally, I add a dummy variable equal to 1 if the state has a restaurant smoking ban in place and interact it with the tax for 1995-2005.¹³ States with restaurant smoking bans have prices that are an average of 9 cents less than states without bans. This is reflective of the fact that states with bans have smaller demand on average (78 packs/year per capita) than states with no bans (93.5 packs/year per capita). A 10 cent tax increase causes a larger price increase in states with bans (10.8 cents) than in states with no bans (9.9 cents). Neither of these estimates are statistically different from the 1.055 baseline estimate from the 1996-2005 time period.

6.1 BORDER CROSSING AND BOOTLEGGING

If a state has neighbors with lower taxes, then residents can cross the border to purchase cigarettes. This can cause demand to increase in the lower tax state. The demand increase, in turn, can be expected to cause a price increase in the lower tax state

¹² Year fixed effects are included in this regression as well. Including the federal tax as a separate variable simply reduces the coefficients on the year effects.

¹³ The data for this variable are obtained from the CDC STATE system.

if the market is not competitive. Lower tax areas may experience a surge in demand and price. Likewise, high tax areas can lose demand and see prices fall. Thus, it is not clear which direction border-crossing could bias the results.

The problem of border crossing, or bootlegging, is frequently mentioned in studies of tobacco demand. Chaloupka and Warner (2001) contains an excellent survey of these studies. Demand studies that control for border crossing either restrict the sample to states that do not have lower tax neighbors, or they use a weighted average price based on all taxes in a defined area. Few incidence studies deal with smuggling. In fact, I found only one study by Keeler et al (1996). They include a measure of a state's export potential, determined by both the percent of the population near the border and a measure of the savings to be had by crossing the border. With this additional control, they still find that, on average, taxes are shifted within the taxing state at a rate of 1.11 times the tax.

I begin by creating a dummy variable (*Bootleg*) equal to 1 if the state has at least 1 neighbor with a lower tax rate and equal to 0 otherwise.¹⁴ Figure 3.7 depicts the spatial distribution of this variable at three points in the sample: 1955, 1980, and 2005. In 1955, 15 states do not have a lower tax neighbor. By 1980, this number falls to 9, and by 2005 only 8. The states with no bootlegging opportunities change over the sample, reflecting the numerous state tax changes. In Figure 3.8, I plot average per capita sales in states with lower tax neighbors (*Bootleg* = 1) versus consumption in states with no lower tax neighbors (*Bootleg* = 0). The states with no low-tax neighbors can be thought of as destination states and always have greater average sales than their higher tax neighbors.

¹⁴ Later, I create a measure of how much of the state's population resides near a lower tax state.

Together, these descriptive statistics provide evidence that some border crossing does occur.

In Table 3.5, I add an interaction of the tax and *Bootleg* to equation (3.5). In states with lower tax neighbors, a 10 cent tax increase is predicted to increase price by 11.9 cents. Meanwhile, that same 10 cent tax increases price by 13.1 cents in the states with no lower tax neighbors. The baseline results of 1.19 falls in between these two estimates. The same is true for the real dollar estimates. Thus, while the earlier results may understate the eventual impact of one low tax state's tax on price, they overstate the impact in states with a lower tax neighbor.

Using a state-level measure of border crossing is not ideal. For example, Louisiana frequently has a lower state tax than Texas (so Texas is assigned *Bootleg* = 1). However, it is unlikely that residents of El Paso in western Texas drive the 880 miles to Louisiana to save a few cents or dollars on a pack of cigarettes. For this reason, I create a second measure of border crossing potential equal to the percent of a state's population that resides in a county adjacent to a state with a lower tax.¹⁵ The numbers inside each state in Figure 3.7 represent this variable. In 2005, Texas is designated as a potential border crossing state with the state level measure, yet only 2% of the state population lives in a county adjacent to a lower tax state. As shown in Panel B of Table 3.5, using this variable yields coefficients that are smaller than those obtained with the state level measure. A ten cent tax increase in a state with no low-tax neighbor is predicted to increase price by 12 cents, while a 10 cent tax in a state with *Bootleg* = 1 causes price to increase by 11.5 cents. As expected, using the county-level measure compresses the

¹⁵ County population data are obtained from the US Census Bureau, Census 2000 Summary File 1.

spread between the two types of border crossing states from the state results. Altogether, while border crossing does increase demand in some low-tax areas, it does not bias the baseline results by a statistically significant amount with either the state- or county-level measure.

6.2 DYNAMICS AND LONG-RUN EFFECTS OF TAXATION

Prices might not react to tax changes instantaneously. None of the tobacco excise tax incidence literature takes this into account. Besley and Rosen (1999), however, do account for dynamics in their analysis of general sales tax incidence by adding a series of lags to the regression. First, I add lagged values of the tax rate to equation (3.5). Many of the lagged coefficients are insignificant, due to the small amounts of variation in each cell. Besley and Rosen point out that while the individual lag coefficients are not always significant, the sum of the lags and the tax coefficient can be interpreted as a long-run effect of the tax. Table 3.6 contains results with 5, 10, 15, 20, 25, and 30-year lags. In all cases, the tax coefficient alone is not significantly different from 1, but the long-run impacts are significantly different from 1. Depending on the number of lags, the long-run effect is bounded between 1.231 and 1.311. This means a 10 cent tax increase causes a 10 cent price increase immediately, and a 12.3 to 13 cents price increase further in the future.

Applying a structure to the lags grants the ability to infer something about the lag length. I impose the simplest lag structure, which is that the lags decline geometrically. After some algebraic manipulation, the new regression equation becomes:

$$p_{jt} = \mathbf{b}t_{jt} + \mathbf{l} p_{j,t-1} + STATE_j + YEAR_t + \mathbf{e}_{jt} \quad (3.6)$$

The coefficient on lagged price, I , provides a measure of the rate of decay of the lag distribution. A lower value of I indicates a faster rate of decay of the effect of prior price ($I = 0$ implies instantaneous adjustment). A faster rate of decay means that more of the impact of the tax occurs immediately. The short-run impact of the tax is given by the coefficient on the tax (b), while the long-run effect is the short-run impact divided by $(1 - I)$. Results from this estimation are presented in Table 3.6.

This procedure further implies that it takes time for the price to adjust fully to a tax hike. In the regression with no lags, the real coefficient on tax over all years equals 1.171. Once the lags are introduced, this short-run value falls to .845. The real lag coefficient equals .339, and it thus implies a lag length of 0.508 years. This indicates that around half of the ultimate price reaction to the tax occurs in the year it is implemented. Likewise, the long-run effect of the tax is 1.274, which is considerably larger than the short-run value of 0.845.

All of my results assume that the error term is uncorrelated over time. I test for autocorrelation across the panels, and I am unable to reject the hypothesis of no autocorrelation. However, when I estimate a Prais-Winsten correction for autocorrelation with panel correlated standard errors, I get results that are greater than 1 and not significantly different from the baseline results. Thus, I conclude that autocorrelation is not a problem with my analysis.

7. CONCLUDING REMARKS

This analysis determines the proportion of a tobacco excise tax that is paid by consumers. The basic results imply that the tax is fully shifted onto consumers, and in many cases the shifting coefficient is significantly greater than 1. Dynamic estimates

indicate that consumers pay 130% of the tobacco tax in the long-run. Border crossing may increase demand in low-tax areas and cause the price to increase by amounts greater than predicted in low-tax states, and may decrease demand and price in high-tax areas. However, my results indicate that bootlegging activity does not change the main results by a significant amount.

Several additional factors may explain why the tax and price do not have one-to-one relationship. The tobacco industry is thought by many to exhibit imperfectly competitive behavior. In fact Sumner (1981) and Sullivan (1985) each arrive at similar results of overshifting when attempting to estimate the level of competition in the tobacco manufacturing industry. Barzel (1976) claims that the tax increase induces the manufacturers to improve the quality of their product. Under this hypothesis, the price increase reflects a higher level of product quality, *not* just the tax hike. Becker et al (1944) claim that the overshifting is not surprising when consumers are addictive and the market is not competitive, writing "If smokers are addicted and if the industry is oligopolistic, an expected rise in future taxes and hence in future prices induces a rise in current prices even though current demand falls when future prices are expected to increase" (p. 413).

My results also indicate that the ability of tobacco manufacturers and distributors to pass the tax on to consumers has changed over time. Using data after 1996, price is predicted to change by the same amount as tax. This is in large part due to the settlement between the states and manufacturers, which had the same effect as if the government increased the federal excise tax every year that a payment is required.

TABLE 1.1 ESTIMATES FROM PREVIOUS LITERATURE

Author (year)	Data and Years	Persons Considered	Tax	Marginal Effect
Marry or Not Marry				
Dickert-Conlin and Houser (2002)	SIPP 1989-1995	Initially unmarried women age 18-50 with children	Changes in EITC between married and not married	No effect
Marry or Separate				
Dickert-Conlin and Houser (2002)	SIPP 1989-1995	Initially married women age 18-50 with children	Changes in EITC between married and not married	0.0079 (0.011)
Dickert-Conlin (1999)	1990 SIPP	Married women age 18-44 that eventually separate	Changes in taxes and transfer programs	0.0041
Marry or Cohabit				
Eissa and Hoynes (2000)	March CPS 1984-1997	Married or Cohabiting women age 18-47	Changes in federal income tax between married and not married	-0.004
Alm and Whittington (2003)	PSID	Initial cohabiters age 18+ who eventually marry	Changes in federal income tax between married and not married	-0.00002 (-0.1)

Parentheses contain the tax-price elasticity of marriage where they are available. The marginal effect is defined as $\partial F(\mathbf{x}\mathbf{b})/\partial \mathbf{x}$ where $F(\mathbf{x}\mathbf{b})$ is the distribution function evaluated at the mean values of the covariates \mathbf{X} with coefficients \mathbf{b} . The elasticity of marriage with respect to the marriage tax is the percentage change in the likelihood of marriage for a percentage change in the marriage tax.

TABLE 1.2 DESCRIPTIVE STATISTICS FOR HOUSEHOLD HEADS

	Single	Cohabit	Married	Separated
N	13,796	2,033	25,978	2,201
Age	41.07 (12.25)	33.90 (10.40)	42.42 (10.85)	41.22 (10.66)
Education	12.97 (2.83)	12.75 (2.39)	13.11 (2.92)	11.96 (3.13)
Any Kids (0 or 1)	0.24 (0.43)	0.32 (0.47)	0.57 (0.49)	0.47 (0.50)
Number of children <18	0.41 (0.86)	0.52 (0.90)	1.11 (1.21)	0.92 (1.23)
Not White	0.20 (0.40)	0.16 (0.36)	0.10 (0.30)	0.30 (0.46)
MSA (0 or 1)	0.80 (0.40)	0.76 (0.43)	0.74 (0.44)	0.80 (0.40)
Own Earnings (2000 \$)	17,112.36 (19,830.86)	17,661.20 (20,781.82)	26,485.53 (27,804.27)	14,848.71 (24,081.94)
Partner Earnings (2000 \$)		14,181.20 (14,119.07)	14,288.40 (21,328.49)	
Imputed Partner Earnings (2000 \$)	20,440.59 (24,483.33)			22,790.05 (29,560.46)
Total Earnings (2000 \$)	37,539.09 (25,056.10)	31,842.40 (28,814.51)	40,773.92 (36,189.13)	34,456.82 (28,206.65)
Partnerable men ratio	0.77 (0.54)	0.82 (0.51)	0.90 (0.50)	0.77 (0.48)
Female	0.61 (0.49)	0.45 (0.50)	0.14 (0.35)	0.67 (0.47)
Tax Cost – Wife gets kids	87.98 (1754.11)	184.20 (1101.96)	-194.06 (1709.82)	3.18 (1540.73)
Tax Cost - Primary Earner gets kids	87.98 (1754.11)	184.20 (1101.96)	209.26 (1224.18)	3.18 (1540.73)

Parentheses contain standard errors.

TABLE 1.3 BIVARIATE PROBIT RESULTS

	(1) Alone	(2) Marry
T^w		-6.41e-05** (3.23e-06)
Own Earnings	-1.54e-06** (2.44e-07)	
Partner Earnings	1.05e-06** (3.20e-07)	
Partnerable Men Ratio	-0.0004 (0.0105)	
Any Kids	-0.796** (0.028)	0.797** (0.027)
Number Kids < 18	-0.133** (0.013)	0.199** (0.013)
Age	-0.010* (0.005)	0.039** (0.004)
Age ²	-0.0003 (0.00005)	-0.0002** (0.00005)
Education	-0.029* (0.010)	-0.019 (0.011)
Education ²	0.0002 (0.0004)	0.002** (0.0004)
Not White	0.422** (0.019)	-0.275** (0.019)
MSA	0.061** (0.017)	-0.041* (0.017)
Female	1.334** (0.158)	-1.234** (0.146)
Constant	-0.081 (0.111)	-0.867** (0.111)
Observations	43349	43349
$\rho = -0.918$		

Standard errors are contained in parentheses. ** Significant at 99% level of confidence. * Significant at 95% level of confidence

TABLE 1.4 MARGINAL EFFECTS

	Single	Cohabit	Married	Separated
T^W	1.08E-06 (1.98)	1.18E-06 (1.98)	-1.18E-06 (-1.98)	1.08E-06 (1.98)
Own Earnings	-2.41E-07 (-6.26)	2.41E-07 (6.26)	3.06E-07 (6.32)	-3.06E-07 (-6.32)
Partner Earnings	1.65E-06 (3.29)	-1.65E-06 (-3.29)	-2.09E-06 (-3.29)	2.09E-06 (3.29)
Partnerable Men Ratio	-0.00005 (-0.04)	0.00005 (0.04)	0.00007 (0.04)	-0.0007 (-0.04)
Any Kids	-0.249 (-33.41)	-0.021 (-6.31)	0.293 (33.71)	-0.023 (-6.47)
Number Kids < 18	-0.054 (-14.43)	-0.016 (-9.05)	0.063 (14.21)	0.007 (3.82)
Age	-0.005 (-3.67)	-0.009 (-14.14)	0.005 (3.21)	0.008 (12.89)
Age ²	-1.68E-05 (-1.05)	7.66E-05 (10.46)	-2.64E-05 (-1.41)	-8.63E-05 (-10.87)
Education	-0.0012 (-0.39)	0.008 (5.45)	0.002 (0.57)	-0.009 (-5.60)
Education ²	-0.0002 (-1.71)	-0.0003 (-4.88)	0.0002 (0.57)	0.0003 (4.25)
Not White Dummy	0.118 (17.41)	-0.017 (-7.92)	-0.142 (-19.22)	0.041 (11.37)
MSA	0.016 (3.29)	-0.002 (-0.94)	-0.019 (-3.32)	0.005 (2.24)
Female	0.444 (95.91)	0.002 (19.91)	-0.482 (-103.62)	0.037 (16.06)
P_{ij}	0.255	0.054	0.630	0.061

Marginal effects are calculated at the means according to the method outlined in Greene(1998) and indicate the percentage change in the alternative for a given unit change in the independent variable. P_{ij} is the percentage of households predicted to choose the given alternative. Parentheses contain Z values.

TABLE 1.5 ALTERNATE SPECIFICATIONS & CHECKS FOR ROBUSTNESS

	(1)	(2)	(3)	(4)	(5)
	Coefficient on Tax	Single	Cohabit	Married	Separated
Base Case	-6.41	1.08	1.18	-1.18	-1.08
Fixed Effects					
State	-6.37	1.08	1.16	-1.16	1.08
Year	-6.84	1.16	1.25	-1.25	-1.16
State & Year	-6.87	1.17	1.25	-1.25	-1.17
Total Earnings	-6.02	1.02	1.10	-1.10	-1.102
T ^{PE}	-8.25	1.45	1.57	-1.57	-1.45

Column (1) contains coefficients on the tax variable, while columns (2)-(5) contain the corresponding marginal effects. The first row contains the 'base' case followed by 3 rows where I add in fixed effects. Next, I use total earnings in place of own earnings and partner earnings. Then I estimate the 'base' model using T^{PE}. All presented coefficients and marginal effects are in 10⁻⁶ and significant at the 99% level of confidence.

TABLE 1.6 SPECIFICATIONS FOR COMPARISONS WITH PREVIOUS LITERATURE

	Marginal Effect
Marry – Not Marry for full sample	
Fixed Effects	
None	-6.29 (-3.91)
State	-6.34 (-3.92)
Year	-6.47 (-4.02)
State & Year	-6.51 (-4.03)
Marry – Not Marry for not alone persons	
Fixed Effects	
None	-9.85 (-11.18)
State	-9.43 (-11.22)
Year	-9.65 (-11.22)
State & Year	-9.20 (-11.24)

The dependent variable in both panels is a dummy variable indicating if the individual is married or not. The top panel considers the choice to marry for all household heads. The bottom panel eliminates *alone* individuals and considers the choice to marry only for household heads that live with a partner. Marginal effects are all 10^{-6} . Parentheses contain Z statistics.

TABLE 1.7 SIMULATION OF RESULTS BY DEMOGRAPHIC CHARACTERISTICS

AGE	25	35	45	55	AGE	25	35	45	55
White, 1 kid					White, 0 kids				
P(single)	19%	14.9%	10.8%	7.5%	P(single)	52.9%	46.9%	39.4%	32.1%
P(cohabit)	9.8%	4.7%	2.6%	1.9%	P(cohabit)	13.6%	8.2%	5.7%	5.0%
P(married)	69%	76.2%	81.6%	86.3%	P(married)	31.4%	39.9%	47.6%	55.3%
P(separated)	2.2%	4.1%	5.0%	4.3%	P(separated)	2.1%	5.0%	7.3%	7.6%
Elasticity	0.0002	0.00009	0.00006	0.00004	elasticity	0.0004	0.0002	0.0002	0.0001
Not White, 1 kid					Not White, 0 kids				
P(single)	31.1%	24.6%	18.4%	13.5%	P(single)	67.8%	61.2%	53.1%	45.1%
P(cohabit)	8.1%	3.8%	2.1%	1.6%	P(cohabit)	8.3%	4.8%	3.3%	3.1%
P(married)	56.3%	63.5%	69.7%	75.9%	P(married)	20.8%	26.9%	33.1%	40.3%
P(separated)	4.5%	8.1%	9.8%	8.9%	P(separated)	3.1%	7.0%	10.4%	11.5%
Elasticity	0.0002	0.0001	0.00006	0.00004	elasticity	0.0004	0.0003	0.0002	0.0001

Each predicted probability is calculated for a high school graduate at the age, race, and number of children stated and all other variables set equal to their means. The reported elasticity of marriage is with respect to the marriage tax.

TABLE 1.8 RESULTS BY TAX QUARTILE

	75% - 100%	50% - 75%	25% - 50%	0% - 25%
Mean	\$1,646.19	\$380.53	-\$195.25	-\$2,154.66
P(single)	19.6%	15.2%	13.6%	14.2%
P(cohabit)	5.6%	4.8%	4.6%	4.7%
P(married)	70.2%	75.9%	77.9%	77.2%
P(separated)	4.6%	4.1%	3.8%	3.9%
Elasticity	0.0028	0.0005	0.0002	0.0029

Each predicted probability is calculated for a white 35 year old with 1 kid, at the tax listed in the column head, and all other variables at their means. The elasticity of marriage is calculated with respect to the marriage tax.

TABLE 2.1 SUMMARY STATISTICS, PSID 2001-2003

	Mean	Std. Dev.	Min	Max
Age of Head	41.98	11.41	16	64
Married	0.50	0.50	0	1
Number of Kids	0.75	1.09	0	8
Education of Head	13.28	2.71	0	17
Male Head	0.71	0.45	0	1
White Head	0.74	0.44	0	1
Protestant	0.34	0.47	0	1
Catholic	0.17	0.38	0	1
Jewish	0.02	0.13	0	1
Other Religion	0.37	0.48	0	1
No Affiliation	0.10	0.30	0	1
Own	0.61	0.49	0	1
Emergency Food	0.02	0.15	0	1
Itemize	0.43	0.49	0	1
Donate to Charity	0.64	0.48	0	1
Donate Itemize=1	0.88	0.33	0	1
Donate Itemize=0	0.47	0.50	0	1
Income	64,658.42	80,994.16	-59,948	3,660,650
Federal + State MTR	22.28	13.31	-72.79	69.6
Price(1-t)	0.879	0.154	0.304	1
Price Gifts>0	0.831	0.160	0.304	1
Price Gifts=0	0.965	0.093	0.536	1
Price Itemize	0.712	0.091	0.304	1

Notes: N=13,615 – Excludes Self-Employed, Farmers and age>64.
 Statistics are weighted by the PSID family weights.

TABLE 2.2 DONATION STATISTICS

N	All 13,544		Income<31,000 4,476		31,000<Income<62,000 4,508		Income>62,000 4,560	
	E(g g>0)	N	E(g g>0)	N	E(g g>0)	N	E(g g>0)	N
Gifts	\$1,826.81	6547	\$892.78	1055	\$1,110.45	2148	\$2,569.77	3344
Index Gifts	536.49	6433	261.30	1030	334.38	2111	748.49	3292
Religious	1,697.68	4517	764.54	715	1,161.24	1455	2,282.01	2347
Combo	508.78	2993	576.91	308	244.93	932	634.11	1753
Needy	468.41	2715	363.56	344	297.16	800	579.57	1571
Health	268.21	1783	114.01	175	175.98	505	339.46	1103
Education	389.38	1430	125.28	121	160.25	358	514.49	951
Social Services	474.04	3034	348.73	381	325.14	899	579.12	1754
Other	351.17	1150	339.54	120	194.63	333	433.61	697
Youth	216.21	577	99.66	52	245.64	172	218.05	353
Arts	197.60	329	152.09	30	143.48	83	231.60	216
Community	150.62	257	117.15	27	139.24	76	162.56	154
Environment	150.11	367	101.12	23	95.68	97	178.14	247
International	372.73	180	1,668.00	14	109.98	55	299.37	180

Notes: Statistics are weighted by the PSID family weights.

TABLE 2.3 INDEX VALUES

Category	Index
Arts/Culture	0.139
Education	0.145
Health Services	0.245
Foundations	0.275
Religious	0.287
Social Services	0.498

Source: Author's calculations. See Appendix 2A for more detailed information.

TABLE 2.4 TOBIT ESTIMATES OF LN (GIVING)

	(1)	(2)	(3)	(4)	(5)
ln price	-2.258*** [0.094]	-1.905*** [0.096]	-1.897*** [0.096]	-1.745*** [0.098]	-1.759*** [.095]
ln income	0.627*** [0.026]	0.509*** [0.027]	0.512*** [0.027]	0.472*** [0.028]	0.473*** [.023]
Age of head	0.0213*** [0.0015]	0.0238*** [0.0016]	0.0227*** [0.0016]	0.0203*** [0.0016]	0.0205*** [.0014]
Married	0.245*** [0.036]	0.487*** [0.046]	0.473*** [0.046]	0.427*** [0.046]	0.416*** [.039]
Number kids	0.0500*** [0.014]	-0.0195 [0.014]	-0.0204 [0.014]	-0.0211 [0.014]	0.0171 [.012]
Year=2003	0.0774*** [0.021]	0.0463** [0.022]	0.0155 [0.036]	0.00462 [0.036]	0.001 [.037]
Education of head		0.142*** [0.0074]	0.140*** [0.0074]	0.140*** [0.0074]	0.139*** [.0061]
Male head		-0.287*** [0.052]	-0.258*** [0.051]	-0.261*** [0.051]	-0.258*** [.041]
White head		0.0037 [0.036]	0.0336 [0.036]	0.011 [0.036]	0.038 [.033]
Protestant			0.495*** [0.063]	0.482*** [0.063]	0.473*** [.053]
Catholic			0.248*** [0.071]	0.241*** [0.071]	0.246*** [.061]
Jewish			0.298** [0.13]	0.336*** [0.13]	0.359*** [.143]
Other religion			0.349*** [0.070]	0.331*** [0.070]	0.321*** [.059]
Own				0.260*** [0.040]	0.247*** [.035]
Emergency food				-0.379*** [0.089]	-0.366*** [.091]
state fixed effects	no	no	no	no	Yes
Observations	13483	12602	12602	12601	12601

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

TABLE 2.5 PRICE AND INCOME ELASTICITIES BY CATEGORY

	Price		Income		Observations
	ϵ	s.e.	η	s.e.	
Gifts	-1.745***	[0.098]	0.472***	[0.028]	12601
Index Gifts	-1.336***	[0.075]	0.342***	[0.020]	12611
Social Services	-0.637***	[0.071]	0.222***	[0.019]	12636
Religious	-1.150***	[0.10]	0.220***	[0.026]	12661
Needy	-0.653***	[0.073]	0.200***	[0.020]	12644
Combo Purpose	-0.689***	[0.071]	0.296***	[0.020]	12660
Health	-0.379***	[0.061]	0.164***	[0.017]	12657
Education	-0.356***	[0.066]	0.180***	[0.019]	12660
Arts	-0.224**	[0.099]	0.105***	[0.031]	6514
Community	-0.0456	[0.10]	0.108***	[0.028]	6513
Youth & Family	-0.108	[0.092]	0.138***	[0.027]	6509
Environment	-0.297***	[0.090]	0.136***	[0.024]	6512
International	-0.421***	[0.13]	0.104***	[0.039]	6515
Other	-0.253***	[0.073]	0.163***	[0.020]	12661

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

TABLE 2.6 COMPARING THE USE OF SPLINES IN PRICE AND INCOME FOR TOTAL GIVING

	(1)	(2)	(3)	(4)
Price	-1.745 [0.098]	-1.884 [0.10]		
Price 1			-3.110 [0.44]	-3.189 [0.44]
Price 2			-2.308 [0.16]	-2.172 [0.16]
Price 3			-1.525 [0.20]	-1.728 [0.11]
Income	0.472 [0.028]		0.507 [0.029]	
Income 1		0.497 [0.052]		-0.3 [0.21]
Income 2		0.760 [0.078]		0.609 [0.034]
Income 3		0.125 [0.048]		0.190 [0.054]

Numbers are elasticities. Standard errors in brackets.

TABLE 2.7 PRICE AND INCOME ELASTICITIES BY CATEGORY WITH A SPLINE IN PRICE

	Income Elasticity		Price Elasticity		Price Elasticity		Price Elasticity	Obs.	
	η	s.e.	ϵ	s.e.	ϵ	s.e.			
Gifts	0.507	[0.029]	-3.11	[0.44]	-2.308	[0.16]	-1.525	[0.10]	12601
Index Gifts	0.366	[0.022]	-2.357	[0.33]	-1.686	[0.16]	-1.191	[0.080]	12611
Social Services	0.237	[0.021]	-0.979	[0.31]	-0.886	[0.11]	-0.553	[0.078]	12636
Religious	0.257	[0.027]	-2.46	[0.38]	-1.724	[0.17]	-0.93	[0.11]	12661
Needy	0.215	[0.021]	-1.074	[0.30]	-0.862	[0.12]	-0.575	[0.080]	12644
Combo Purpose	0.305	[0.021]	-0.854	[0.29]	-0.827	[0.11]	-0.644	[0.077]	12660
Health	0.165	[0.018]	-0.49	[0.25]	-0.361	[0.10]	-0.378	[0.066]	12657
Education	0.184	[0.021]	-0.611	[0.27]	-0.355	[0.11]	-0.345	[0.071]	12660
Arts	0.136	[0.035]	-1.063	[0.32]	-0.506	[0.14]	-0.111	[0.11]	6514
Community	0.119	[0.30]	-0.163	[0.43]	-0.236	[0.17]	0.0059	[0.11]	6513
Youth & Family	0.153	[0.029]	-0.096	[0.39]	-0.402	[0.15]	-0.037	[0.099]	6509
Environment	0.144	[0.026]	-0.212	[0.43]	-0.453	[0.14]	-0.261	[0.095]	6512
International	0.0986	[0.041]	-0.524	[0.54]	-0.266	[0.21]	-0.449	[0.15]	6515
Other	0.163	[0.021]	-0.055	[0.34]	-0.292	[0.12]	-0.252	[0.077]	12661

Standard errors in brackets

TABLE 2.8 PRICE AND INCOME ELASTICITIES BY CATEGORY WITH A SPLINE IN PRICE – 2003 ONLY

	Income Elasticity		Price Elasticity Income < 31,000		Price Elasticity 31,000< Income < 62,000		Price Elasticity Income > 62,000		Obs.
	η	s.e.	ϵ	s.e.	ϵ	η	s.e.	ϵ	
Gifts	0.468	[0.038]	-3.246	[0.58]	-2.512	[0.22]	-1.505	[0.14]	6472
Index Gifts	0.349	[0.028]	-2.521	[0.43]	-1.866	[0.17]	-1.172	[0.11]	6477
Social Services	0.235	[0.028]	-0.744	[0.40]	-1.014	[0.16]	-0.525	[0.11]	6493
Religious	0.243	[0.035]	-2.968	[0.48]	-1.974	[0.22]	-0.986	[0.14]	6511
Needy	0.191	[0.028]	-0.931	[0.39]	-0.970	[0.16]	-0.559	[0.11]	6501
Combo Purpose	0.288	[0.031]	-1.141	[0.40]	-0.824	[0.16]	-0.547	[0.11]	6511
Health	0.183	[0.026]	-0.906	[0.34]	-0.496	[0.14]	-0.342	[0.092]	6506
Education	0.168	[0.029]	-0.853	[0.34]	-0.575	[0.15]	-0.325	[0.10]	6510
Arts	0.136	[0.035]	-1.063	[0.32]	-0.506	[0.14]	-0.111	[0.11]	6514
Community	0.119	[0.030]	-0.163	[0.43]	-0.236	[0.17]	0.0059	[0.11]	6513
Youth & Family	0.153	[0.029]	-0.096	[0.39]	-0.402	[0.15]	-0.037	[0.099]	6509
Environment	0.144	[0.025]	-0.212	[0.43]	-0.453	[0.14]	-0.261	[0.095]	6512
International	0.0986	[0.041]	-0.524	[0.54]	-0.266	[0.21]	-0.449	[0.15]	6515
Other	0.115	[0.037]	0.344	[0.60]	-0.400	[0.22]	-0.147	[0.14]	6513

Standard errors in brackets

TABLE 2.9 PRICE AND INCOME ELASTICITIES BY CATEGORY WITH A PRICE SPLINE USING RANDOM EFFECTS TOBIT MODEL

	Income Elasticity		Price Elasticity Income < 31,000		Price Elasticity 31,000 < Income < 62,000		Price Elasticity Income > 62,000		Obs.	Groups
	η	s.e.	ϵ	s.e.	ϵ	s.e.	ϵ	s.e.		
Gifts	0.482	[0.023]	-2.679	[0.36]	-1.880	[0.15]	-1.317	[0.10]	12601	7181
Index Gifts	0.350	[0.017]	-1.974	[0.26]	-1.351	[0.11]	-1.015	[0.075]	12611	7184
Social Services	0.234	[0.018]	-0.961	[0.28]	-0.873	[0.11]	-0.549	[0.072]	12636	7190
Religious	0.251	[0.023]	-1.894	[0.33]	-1.276	[0.14]	-0.771	[0.095]	12661	7193
Needy	0.213	[0.019]	-1.057	[0.28]	-0.850	[0.11]	-0.571	[0.074]	12644	7191
Combo Purpose	0.300	[0.018]	-0.818	[0.28]	-0.805	[0.11]	-0.633	[0.070]	12660	7191
Health	0.164	[0.016]	-0.485	[0.25]	-0.355	[0.099]	-0.375	[0.062]	12657	7190
Education	0.182	[0.018]	-0.602	[0.26]	-0.348	[0.11]	-0.182	[0.018]	12660	7190
Other	0.162	[0.002]	-0.0546	[0.35]	-0.292	[0.12]	-0.251	[0.076]	12661	7191

Standard errors in brackets

TABLE 2.10 IMPACT ON TOTAL GIVING AND TAX COLLECTIONS UNDER VARIOUS REFORMS

Change (in millions)								
	Current Law		No Deduction		All can deduct		20% Credit	
	G	T	ΔG	ΔT	ΔG	ΔT	ΔG	ΔT
Poorest Tercile	18987	6622	-1124	68	3818	-193	17193	-1495
Middle Tercile	37939	110419	-8672	787	8954	-424	11290	-5788
Richest Tercile	99024	820354	-37686	14278	9613	-3287	-12662	-9536
Non-Itemizers	37700	238726	0	0	22385	-3905	25647	-8612
Itemizers	118250	698669	-47482	15133	0	0	-9826	-8207
Total	155950	937394	-47482	15133	22385	-3905	15822	-16819

Percent Changes								
	Current Law		No Deduction		All can deduct		20% Credit	
	G	T	%ΔG	%ΔT	%ΔG	%ΔT	%ΔG	%ΔT
Poorest Tercile	18987	6622	-0.059	0.004	0.201	-0.010	0.906	-0.079
Middle Tercile	37939	110419	-0.229	0.021	0.236	-0.011	0.298	-0.153
Richest Tercile	99024	820354	-0.381	0.144	0.097	-0.033	-0.128	-0.096
Non-Itemizers	37700	238726	0.000	0.000	0.594	-0.104	0.680	-0.228
Itemizers	118250	698669	-0.402	0.128	0.000	0.000	-0.083	-0.069
Total	155950	937394	-0.304	0.097	0.144	-0.025	0.101	-0.108

TABLE 2.11 PERCENT CHANGE IN DONATION BY CATEGORY OF GIVING UNDER REFORM

	No Deductions				All can deduct				20% Credit			
	Total	Poor	Middle	Rich	Total	Poor	Middle	Rich	Total	Poor	Middle	Rich
Gifts	-0.304	-0.059	-0.229	-0.381	0.144	0.201	0.236	0.097	0.101	0.906	0.298	-0.128
Religious	-0.214	-0.062	-0.184	-0.258	0.072	0.091	0.139	0.040	0.084	0.649	0.204	-0.086
Needy	-0.146	-0.041	-0.101	-0.179	0.062	0.068	0.122	0.040	0.014	0.284	0.107	-0.063
Combo Purpose	-0.151	-0.019	-0.096	-0.190	0.068	0.119	0.089	0.053	0.007	0.233	0.106	-0.061
Health	-0.100	-0.010	-0.051	-0.130	0.033	0.033	0.050	0.027	-0.005	0.171	0.045	-0.049
Education	-0.107	-0.016	-0.057	-0.124	0.033	0.077	0.041	0.028	-0.018	0.286	0.039	-0.051
Arts	-0.039	-0.007	-0.069	-0.037	0.056	0.219	0.144	0.009	0.096	0.722	0.131	-0.010
Community	0.019	0.014	0.060	0.003	-0.008	0.001	-0.031	0.000	-0.010	-0.032	-0.022	0.001
Youth & Family	-0.021	-0.001	-0.036	-0.014	0.025	0.021	0.061	0.003	0.031	0.069	0.082	-0.004
Environment	-0.070	-0.004	-0.031	-0.095	0.046	0.057	0.091	0.026	0.035	0.199	0.138	-0.030
International	-0.085	-0.004	-0.034	-0.172	0.086	0.131	0.099	0.042	0.067	0.197	0.110	-0.063
Other	-0.065	0.001	-0.053	-0.085	0.024	0.006	0.040	0.023	-0.006	0.023	0.038	-0.028
Total	-0.177	-0.047	-0.148	-0.214	0.065	0.088	0.121	0.039	0.056	0.505	0.165	-0.072

TABLE 2.12 SHARE OF GIVING TO EACH CATEGORY, BY INCOME, UNDER REFORM

	Current Law				No Deduction			
	All	Poor	Middle	Rich	All	Poor	Middle	Rich
Needy	0.276	0.262	0.303	0.270	0.265	0.259	0.297	0.254
Combo Purpose	0.274	0.290	0.249	0.279	0.263	0.289	0.244	0.266
Health	0.115	0.108	0.121	0.115	0.118	0.108	0.122	0.119
Education	0.126	0.057	0.102	0.145	0.128	0.058	0.103	0.151
Arts	0.036	0.036	0.029	0.038	0.038	0.036	0.030	0.042
Community	0.017	0.021	0.020	0.015	0.019	0.021	0.021	0.018
Youth & Family	0.045	0.028	0.073	0.039	0.050	0.028	0.077	0.045
Environment	0.027	0.019	0.034	0.026	0.028	0.019	0.036	0.027
International	0.027	0.099	0.015	0.018	0.028	0.100	0.015	0.018
Other	0.058	0.080	0.054	0.055	0.061	0.081	0.055	0.060
	All can deduct				20% Credit			
	All	Poor	Middle	Rich	All	Poor	Middle	Rich
Needy	0.277	0.257	0.310	0.270	0.277	0.274	0.309	0.266
Combo Purpose	0.279	0.299	0.251	0.284	0.273	0.290	0.254	0.276
Health	0.114	0.104	0.120	0.114	0.114	0.103	0.116	0.115
Education	0.125	0.057	0.100	0.144	0.123	0.060	0.098	0.145
Arts	0.035	0.035	0.029	0.038	0.039	0.050	0.030	0.040
Community	0.016	0.020	0.018	0.014	0.016	0.017	0.018	0.016
Youth & Family	0.044	0.027	0.070	0.038	0.046	0.024	0.073	0.041
Environment	0.027	0.020	0.034	0.026	0.028	0.019	0.036	0.026
International	0.028	0.104	0.017	0.018	0.028	0.097	0.016	0.018
Other	0.056	0.077	0.052	0.054	0.057	0.066	0.051	0.056

TABLE 2.13 PERCENT OF TOTAL GIVING TO EACH CATEGORY BY INCOME CATEGORY

	Current Law			No Deductions			All can deduct			20% Credit		
	Poor	Middle	Rich	Poor	Middle	Rich	Poor	Middle	Rich	Poor	Middle	Rich
Net Income	0.114	0.248	0.639	0.115	0.248	0.637	0.114	0.248	0.638	0.114	0.248	0.637
Gifts	0.122	0.243	0.635	0.165	0.270	0.565	0.128	0.263	0.609	0.211	0.287	0.503
Religious	0.129	0.259	0.612	0.154	0.268	0.578	0.131	0.275	0.594	0.197	0.287	0.516
Needy	0.106	0.237	0.657	0.120	0.250	0.631	0.107	0.250	0.643	0.135	0.259	0.606
Combo Purpose	0.119	0.197	0.685	0.137	0.209	0.654	0.124	0.201	0.675	0.145	0.216	0.639
Health	0.105	0.227	0.669	0.115	0.239	0.646	0.105	0.231	0.665	0.123	0.238	0.639
Education	0.051	0.175	0.774	0.056	0.185	0.759	0.053	0.176	0.770	0.067	0.185	0.748
Arts	0.112	0.174	0.714	0.115	0.169	0.716	0.129	0.189	0.682	0.175	0.180	0.645
Community	0.143	0.258	0.599	0.142	0.269	0.589	0.145	0.252	0.603	0.140	0.255	0.605
Youth & Family	0.068	0.350	0.582	0.070	0.344	0.586	0.068	0.362	0.570	0.071	0.367	0.562
Environment	0.080	0.275	0.644	0.086	0.287	0.627	0.081	0.287	0.632	0.093	0.303	0.604
International	0.417	0.123	0.459	0.454	0.130	0.416	0.435	0.125	0.441	0.468	0.128	0.404
Other	0.155	0.202	0.643	0.166	0.204	0.630	0.152	0.205	0.643	0.159	0.211	0.630

TABLE 3.1 IS THE RELATIONSHIP BETWEEN PRICE AND TAX CONSISTENT WITH EACH MARKET STRUCTURE?

Observed Relationship between Price and Tax	Perfect Competition	Oligopoly	Monopoly w/ linear demand	Monopoly w/ constant elasticity demand
$\Delta p = \Delta t$	Yes	Yes	Yes	Yes
$\Delta p > \Delta t$	No	Yes	No	Yes
$\Delta p < \Delta t$	No	Yes	Yes	No

TABLE 3.2 ESTIMATES FROM PREVIOUS LITERATURE

	Coefficient on Tax	Years of Data	Differences in Method
Barzel (1976)	1.065 ⁺	1954-1972	no state fixed effects
Johnson (1978)	1.101 ⁺	1954-1972	state fixed effects
Sumner (1981)	1.074 ⁺	1954-1978	omits AK, HI, NJ
Sullivan (1985)	1.089 ⁺	1955-1982	quadratic effects
Barnett et al (1995)	0.976	1955-1990	simulation
Keeler et al (1996)	1.11 ⁺	1960-1990	controls for border crossing and anti- smoking regulations
Evans et al (1999)	0.92	1985-1996	state fixed effects

The symbol + indicates that the coefficient is significantly different from 1 at the 95% level of confidence.

TABLE 3.3 ESTIMATES OF RELATIONSHIP BETWEEN PRICE AND TAX

Panel A.		
	Nominal (1)	Real (2)
1954-2005	1.194 ⁺ (0.025)	1.171 ⁺ (0.019)
1961-2005	1.191 ⁺ (0.025)	1.167 ⁺ (0.020)
1966-2005	1.186 ⁺ (0.025)	1.164 ⁺ (0.021)
1971-2005	1.179 ⁺ (0.025)	1.157 ⁺ (0.022)
1976-2005	1.169 ⁺ (0.025)	1.152 ⁺ (0.024)
1981-2005	1.151 ⁺ (0.025)	1.135 ⁺ (0.024)
1986-2005	1.127 ⁺ (0.025)	1.111 ⁺ (0.025)
1991-2005	1.088 ⁺ (0.026)	1.068 ⁺ (0.027)
1996-2005	1.055 (0.029)	1.039 (0.032)
2001-2005	1.012 (0.031)	1.004 (0.033)
Panel B.		
	Nominal (1)	Real (2)
1954-1965	1.114 ⁺ (0.026)	1.117 ⁺ (0.027)
1966-1975	1.095 ⁺ (0.024)	1.127 ⁺ (0.025)
1976-1985	0.841 (0.067)	0.803 (0.051)
1986-1995	1.249 ⁺ (0.045)	1.215 ⁺ (0.047)
1996-2005	1.055 (0.029)	1.039 (0.032)

Notes: Each row contains the results from the regression of price on tax with controls for state and year over the sample indicated in the first column. Results are computed using both nominal values of the price and tax in column (1), and using constant 2005 dollars in column (2). Parentheses contain heteroskedasticity consistent standard errors. All coefficients are significantly different from 0 at the 95% level of confidence. The symbol + indicates that the coefficient is significantly different from 1 at the 95% level of confidence.

TABLE 3.4 ROBUSTNESS AND SPECIFICATION CHECKS, 1954-2005

	Nominal (1)	Real (2)
Baseline	1.194 ⁺ (0.025)	1.171 ⁺ (0.019)
Changing the Sample		
Omit NJ	1.203 ⁺ (0.028)	1.175 ⁺ (0.021)
Omit HI	1.182 ⁺ (0.025)	1.161 ⁺ (0.020)
Omit NJ & HI	1.189 ⁺ (0.028)	1.164 ⁺ (0.022)
Omit KY, NC, VA	1.202 ⁺ (0.026)	1.175 ⁺ (0.020)
Include Federal Tax	8.148 ⁺ (0.102)	3.000 ⁺ (0.057)
State Tax	1.194 ⁺ (0.025)	1.171 ⁺ (0.019)
Controlling for Anti-Smoking Legislation (1995 - 2005)		
Restaurant Ban Dummy	-8.960 ⁺ (4.455)	-9.904 ⁺ (5.081)
Tax with no restaurant ban	0.993 (0.037)	0.982 (0.042)
Tax with a restaurant ban	1.081 ⁺ (0.082)	1.065 (0.035)

Notes: Parentheses contain heteroskedasticity consistent standard errors. Unless otherwise noted, the sample includes all states from 1954-2005. All coefficients are significantly different from zero at 10% level of confidence. The symbol + indicates that the coefficient is significantly different from 1.

TABLE 3.5 CONTROLLING FOR POTENTIAL BOOTLEGGING

Panel A. State Level Measure of Bootlegging		
	Nominal (1)	Real (2)
Tax (Bootleg = 0)	1.316 (0.031)	1.228 (0.022)
Tax \times Bootleg	-0.121 (0.022)	-0.067 (0.019)
Tax (Bootleg = 1)	1.196 (0.023)	1.160 (0.020)
Panel B. County Level Measure of Bootlegging		
	Nominal (1)	Real (2)
Tax (Bootleg = 0)	1.233 (0.035)	1.191 (0.027)
Tax \times Bootleg	-0.074 (0.032)	-0.044* (0.030)
Tax (Bootleg = 1)	1.158 (0.021)	1.147 (0.019)

Notes. Parentheses contain heteroskedasticity consistent standard errors. All coefficients are significantly different from 0 at 10%, except the with an *.

TABLE 3.6 ALLOWING FOR DYNAMICS WITH LAGS

# of Lags	5	10	15	20	25	30
Tax	1.055	1.054	1.041	1.034	1.017	1.001
	-0.032	-0.034	-0.033	-0.035	-0.035	-0.034
Long-Run	1.231 ⁺	1.258 ⁺	1.284 ⁺	1.302 ⁺	1.260 ⁺	1.311 ⁺
	-0.028	-0.032	-0.041	-0.051	-0.066	-0.106

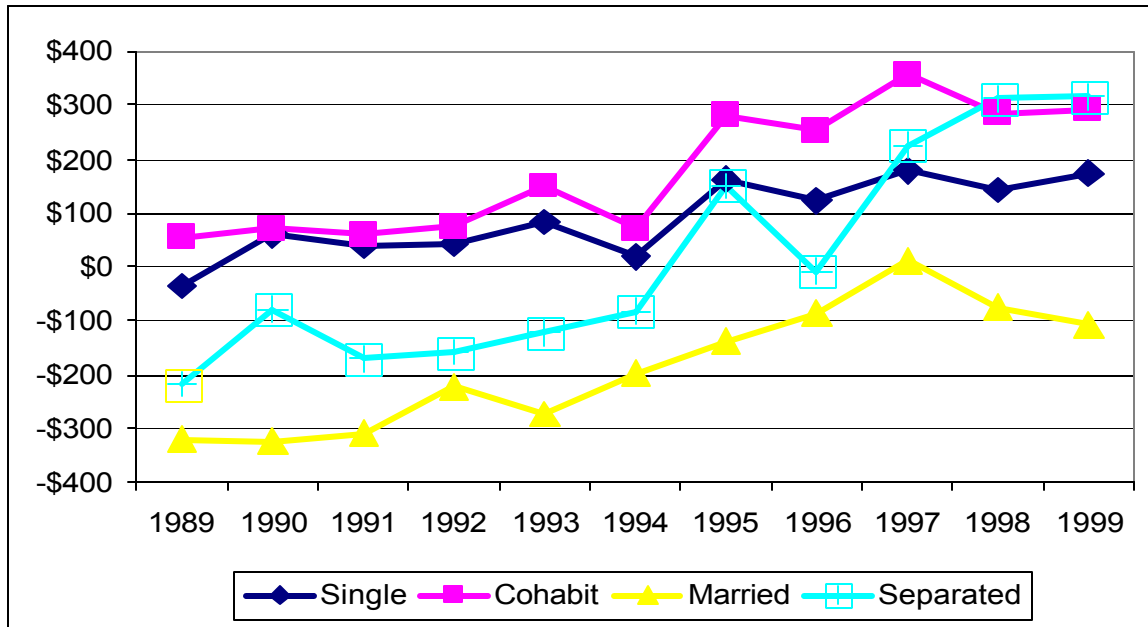
Notes: The first row contains the coefficient of the tax from the regression of price on tax and the number of lagged values of tax indicated at the top of the column. Results are computed using constant 2005 dollars. The long-run effect is computed as the sum of the coefficient on tax and each of the lags. Parentheses contain standard errors. All coefficients are significantly different from 0 at the 95% level of confidence. The symbol + indicates that the coefficient is significantly different from 1.

TABLE 3.7 DYNAMICS WITH A GEOMETRIC LAG STRUCTURE

	Nominal (1)	Real (2)
Short-Run	0.786 (0.037)	0.845 (0.294)
Rate of Decay, I	0.419 (0.033)	0.337 (0.026)
Long-Run	1.355	1.274
Lag Length	0.722	0.508

Notes: Estimates of the effect of tax on price using a geometric lag structure according to equation (3.6). The long-run effect is calculated as the short-run effect divided by $1-I$, where I represents the rate of decay. The average lag length is $I/(1-I)$.

FIGURE 1.2 AVERAGE ANNUAL TAX COST OF MARRIAGE FROM 1989-1999



In this figure, the tax cost of marriage is $T^W = T_M - T_{NMi}^W - T_{NMj}^W$ where T^W assumes that the woman receives custody of children upon divorce. All measured in 2000 \$.

FIGURE 3.1 TAX INCIDENCE UNDER PERFECT COMPETITION

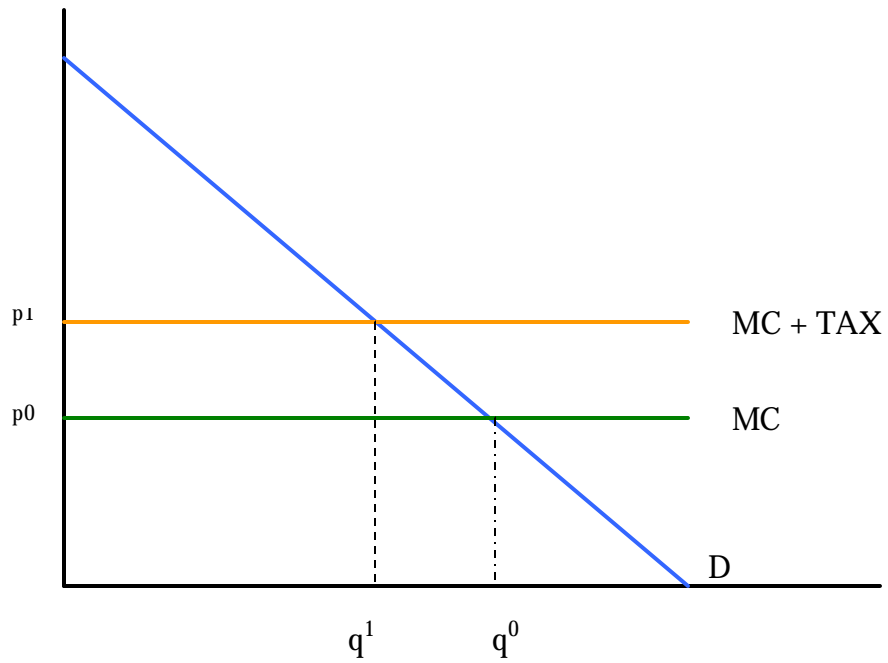
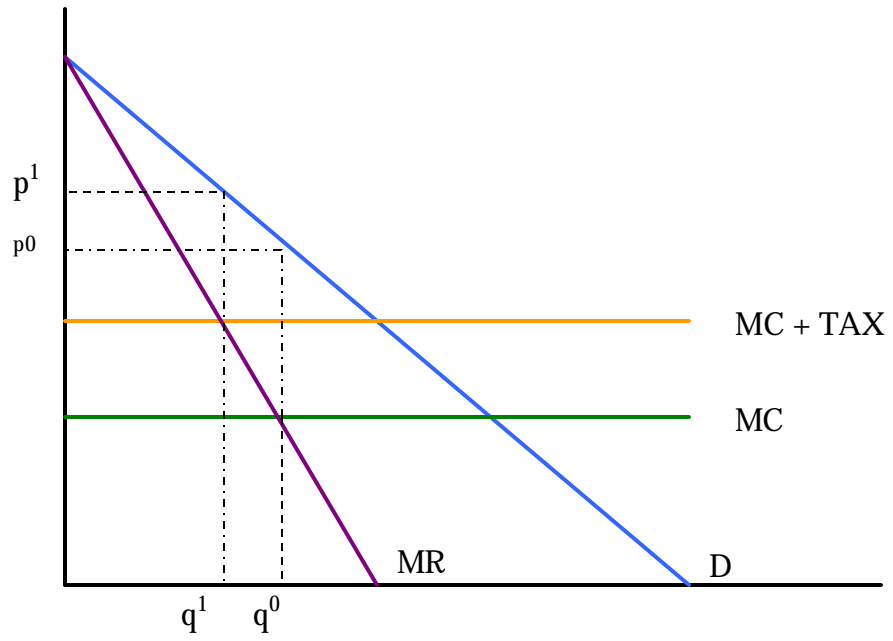


FIGURE 3.2 TAX INCIDENCE UNDER A MONOPOLY

A. Linear Demand



B. Constant Elasticity Demand

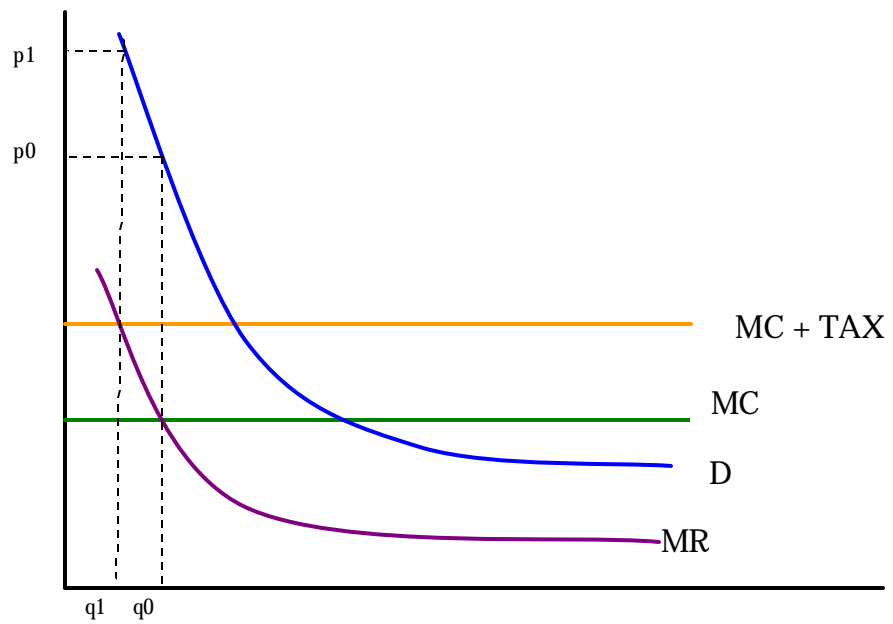


FIGURE 3.3 HISTORY OF THE EXCISE TAX RATE ON TOBACCO 1954-2005

(in nominal cents/pack)

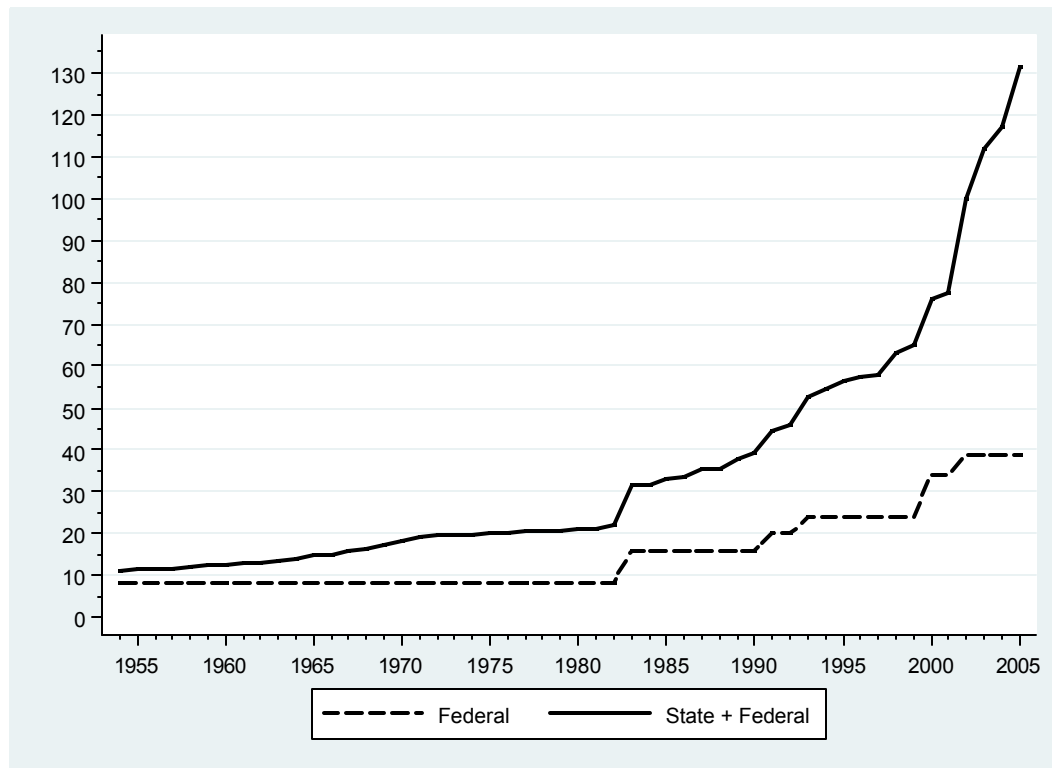
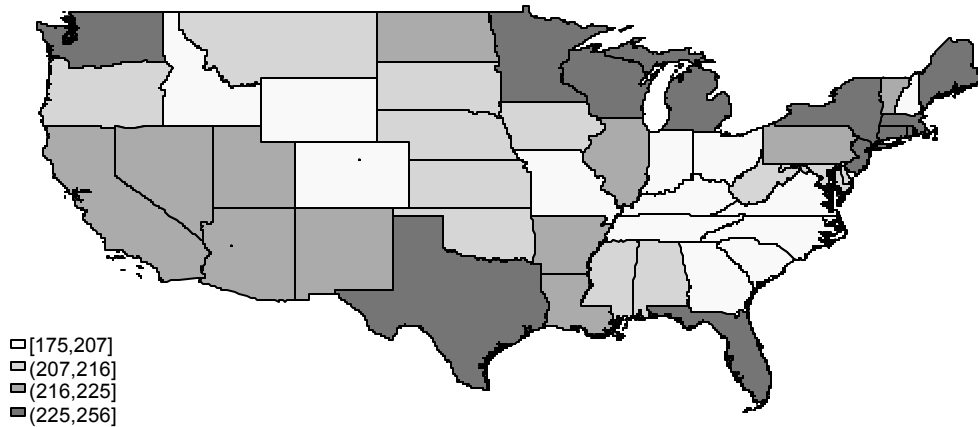
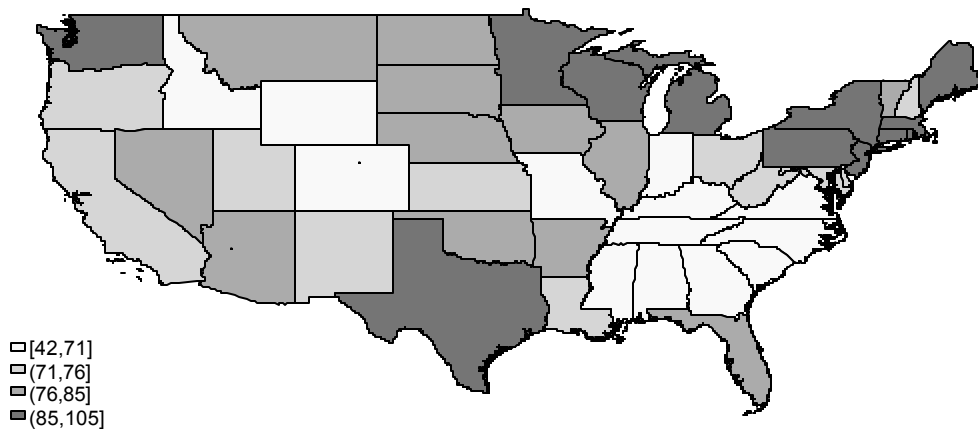


FIGURE 3.4 DISTRIBUTION OF AVERAGE PRICES ACROSS STATES, 1954-2005



Notes: The figure depicts average prices over 1954-2005 for each state measured in real 2005 cents per pack of cigarettes.

FIGURE 3.5 AVERAGE DISTRIBUTION OF STATE EXCISE TAX RATES, 1954-2005



Notes: The figure depicts average statutory tax rates over 1954-2005 for each state measured in real 2005 cents per pack of cigarettes.

FIGURE 3.6 AVERAGE REAL STATE PRICE AND STATUTORY TAX RATES 1954 – 2005

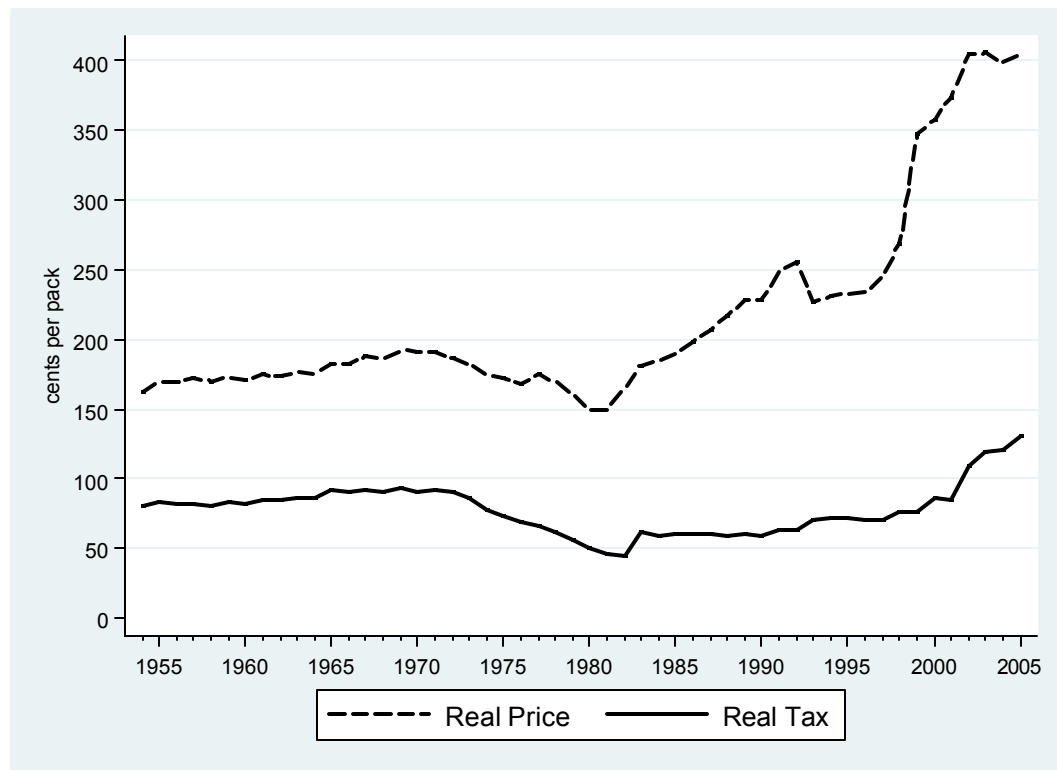


FIGURE 3.7 DISTRIBUTION OF POTENTIAL BOOTLEGGING STATES

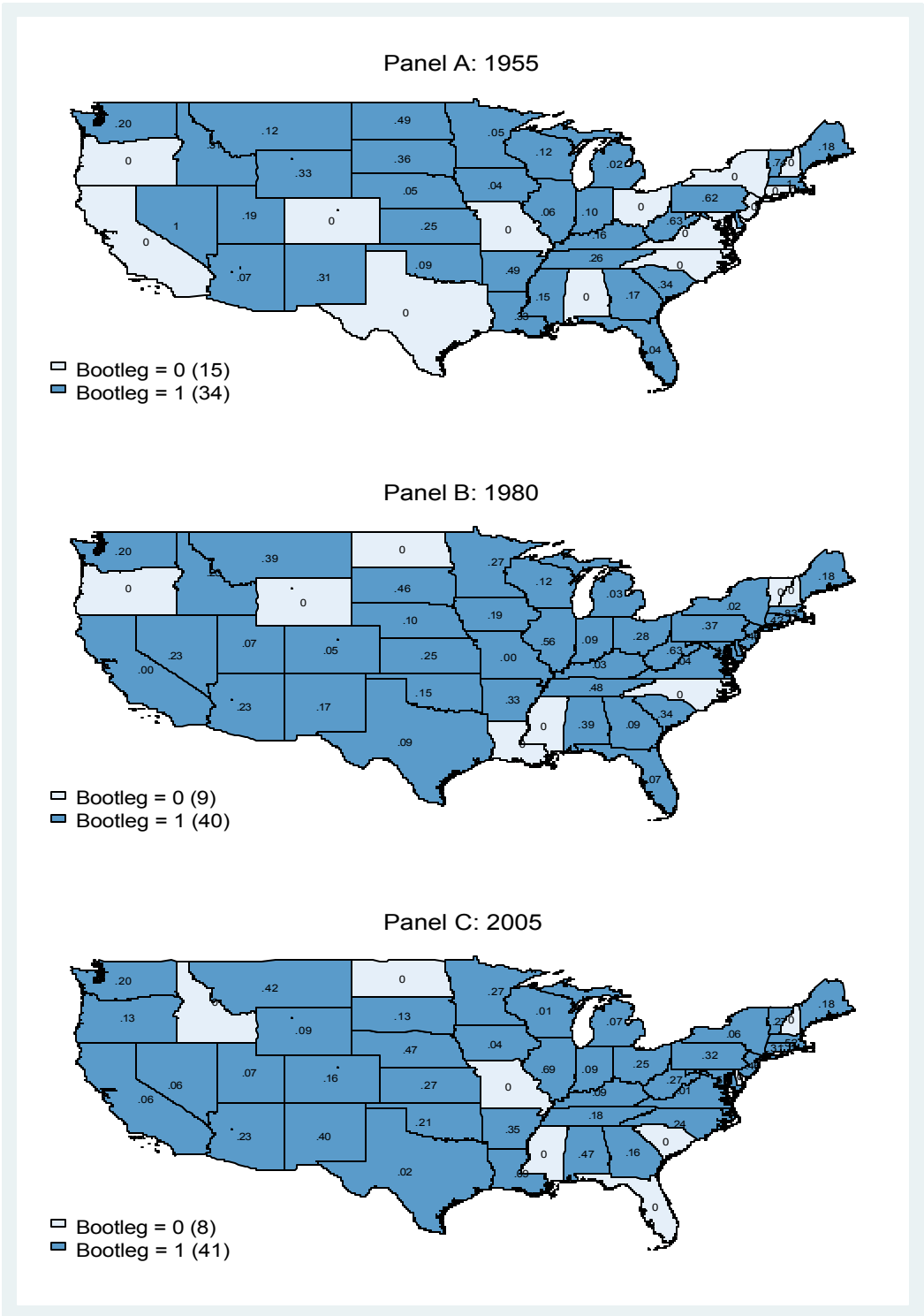
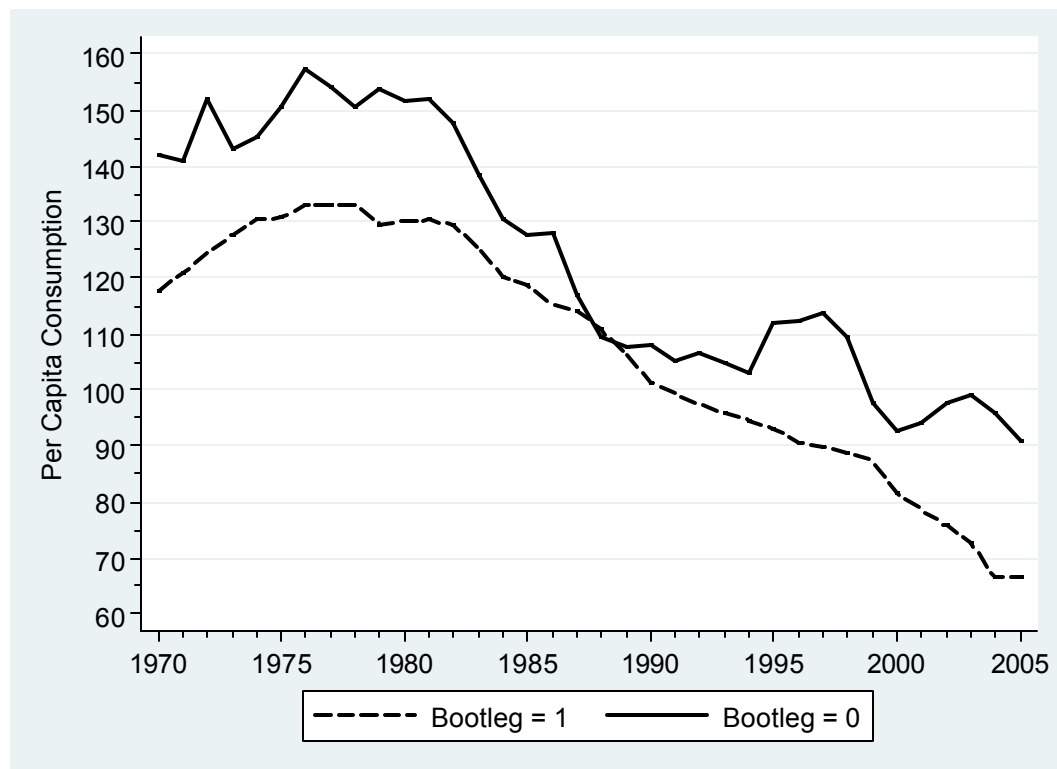


FIGURE 3.8 AVERAGE SALES PER CAPITA IN STATES WITH LOWER TAX NEIGHBORS AND STATES WITHOUT LOWER TAX NEIGHBORS



APPENDICES

APPENDIX 1A. SPOUSAL EARNINGS IMPUTATION EQUATIONS

	(1) Partner Earning	(2) Partner Earning if Male	(3) Partner Earning if Female
Education	-1,385.397 (15.39)**	-425.928 (5.09)**	-2,054.160 (12.74)**
Education ²	120.502 (31.70)**	50.226 (14.29)**	185.236 (26.98)**
Experience	534.518 (38.99)**	213.221 (15.71)**	1,039.341 (44.85)**
Experience ²	-12.821 (60.98)**	-5.812 (28.70)**	-22.980 (62.75)**
Msa	4,461.429 (32.84)**	2,332.285 (17.59)**	6,471.118 (28.13)**
Black	-2,714.121 (11.16)**	1,991.835 (8.47)**	-8,092.147 (19.46)**
Other	-1,867.066 (6.34)**	-410.773 (1.41)	-3,198.289 (6.51)**
Own Earnings	0.004 (1.44)	0.031 (14.98)**	0.054 (8.75)**
State Average Wage	608.700 (12.04)**	87.230 (1.77)	1,070.638 (12.49)**
Minimum Wage	2,494.338 (12.49)**	2,523.781 (12.97)**	2,221.367 (6.55)**
State Unemployment Rate	-160.187 (3.30)**	-74.842 (1.58)	-198.415 (2.40)*
_Iyear_1990	-572.796 (2.37)*	-500.290 (2.12)*	-507.583 (1.24)
_Iyear_1991	-1,516.989 (5.98)**	-1,322.343 (5.35)**	-1,564.798 (3.63)**
_Iyear_1992	-931.614 (3.56)**	-351.289 (1.38)	-1,524.716 (3.43)**
_Iyear_1993	-825.369 (3.34)**	56.081 (0.23)	-1,715.082 (4.09)**
_Iyear_1994	-858.595 (3.57)**	398.430 (1.70)	-2,107.059 (5.16)**
_Iyear_1995	-271.226 (1.12)	893.341 (3.78)**	-1,497.694 (3.63)**
_Iyear_1996	-86.454	-183.798	4.956

	(0.33)	(0.72)	(0.01)
_Iyear_1997			
_Iyear_1998	125.852 (0.44)	465.247 (1.65)	-295.240 (0.60)
_Iyear_1999	927.323 (3.15)**	1,698.547 (5.93)**	53.798 (0.11)
Male	-15,726.247 (127.36)**		
Constant	4,273.618 (4.56)**	-5,375.599 (6.01)**	-6,294.739 (3.88)**
Observations	169758	84879	84879
R-squared	0.21	0.11	0.19

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

APPENDIX 2A. CALCULATION OF INDEX VALUES

Each index, bounded by 0 and 1, represents the fraction of recipients or users with low income multiplied by the fraction of expenditures spent on recipients. To compute these values I use information from “Who Benefits from the Nonprofit Sector?”, edited by Charles Clotfelter. Unless noted otherwise, the poor are those with income less than 2 times the poverty rate.

Religious

$$\begin{aligned}\text{Index} &= \text{fraction of attendees in the bottom 2 income quintiles} \times \\ &\quad \text{fraction of money spent on sacramental activities} \\ &= .382 \times .75 = 0.2865\end{aligned}$$

Note that this measure encompasses 75% of spending by religious organizations. The other activities included general philanthropy and international/missionary work. I do not consider the general philanthropy portion for two reasons. First, I do not know what types of philanthropy the religious organization supports or who benefits from those funds. Second, the PSID category for religious giving specifically asks respondents to separate giving to church sponsored philanthropy into the appropriate activity. For example, donations to a church sponsored soup kitchen are reported as gifts to the Needy, not as gifts to Religious organizations.

Health Services

$$\begin{aligned}\text{Index} &= \text{fraction of users of non-profit hospitals, nursing homes, mental health facilities,} \\ &\quad \text{and substance abuse treatment programs that are poor} \times \text{relative size} + \text{fraction of} \\ &\quad \text{medical research that benefits the poor} \times \text{relative size} \\ &= 0.248 \times 0.5 + 0.242 \times 0.5 = 0.245\end{aligned}$$

Poor users of medical facilities are those with no insurance or Medicaid. I assume medical research benefits everybody equally, and set the fraction of poor who benefit at the percentage of the population that are below 2 times the poverty rate. If medical research does not benefit everyone equally (suppose research produces a new drug that cures a disease, but only the rich can afford it) the my measure will be biased upward.

Education

$$\begin{aligned}\text{Index} &= \text{fraction who attend non-profit secondary school that are poor} \times \text{relative size of} \\ &\quad \text{secondary education} + \text{fraction who attend non-profit universities that are} \\ &\quad \text{poor} \times \text{relative size of non-profit universities} \\ &= [0.09 \times 0.08] + [0.20 \times 0.69] = 0.1452\end{aligned}$$

Combined, secondary and university education comprise 75% of the non-profit education sector. Of course, this measure does not take into account the spending by universities on

research as opposed to teaching. If research activities do not benefit poor recipients as much as teaching, then my measure will be biased upward.

Social Services

Lester Salamon estimated the percent of expenditures that go to the poor using a proprietary survey of non-profits at the Urban Institute. I multiply the fraction that goes to the poor by the relative size of the subcategory, and then sum them up to compute the index value (0.498). The table shows the results:

Category	% to poor (estimated)	Relative size of sector	
Housing	0.326	0.14	0.0456
Social Services	0.439	0.31	0.1360
Multiservice	0.42	0.31	0.1302
Legal, advocacy	0.718	0.02	0.0143
Employment/Training	0.554	0.29	0.1607
Education/Research	0.162	0.26	0.0115
Total			0.498

Arts/Culture

Index = % of attendees with income less than 2 times the poverty rate
= 0.139

This measure includes attendees at classical musicals, operas, plays, musicals, ballet, and art museums.

Foundations

For foundations, a survey asked what types of organizations they fund. I combine those results with the previous index values and sum to get the index value (0.275).

Category of Grantee	% of Gifts	Index
Education	17.1	0.145
Health	20.2	0.245
Social Welfare	27.0	0.498
Scientific Research	19.1	0.242
Arts/Culture	14.5	0.139
Religious	2.0	0.286
Total		0.275

APPENDIX 2B. PSID QUESTIONNAIRE FOR CHARITABLE GIVING

The following are the exact questions asked by the PSID interviewer. For several categories the questioner gives specific examples of what is included in that type of donation.

“Donations include any gifts of money, assets, or property/goods made directly to the organization, through payroll deduction, or collected by other means on behalf of the charity.”

Religious

Did you make any donations specifically for religious purposes or spiritual development, for example to a church, synagogue, mosque, TV or radio ministry? Please do not include donations to schools, hospitals, and other charities run by religious organizations. I will be asking you about these donations next.

Combo Purpose

Did you donate to any organizations that served a combination of purposes? For example, the United Way, the United Jewish Appeal, the Catholic Charities, or your local community foundation?

Needy

Did you make any donations to organizations that help people in need of food, shelter, or other basic necessities?

Education

Did you make donations toward educational purposes? For example, colleges, grade schools, PTAs, libraries, or scholarship funds? Please do not include direct tuition payments for you or other family members.

Youth

Did you make donations to organizations that provide youth or family services?—Such as to scouting, boys’ and girls’ clubs, sports leagues, Big Brothers or Sisters, foster care, or family counseling?

Arts

Did you make donations to organizations that support or promote the arts, culture, or ethnic awareness? Such as, to a museum, theatre, orchestra, public broadcasting, or ethnic cultural awareness?

Community

Did you make donations to organizations that improve neighborhoods and communities? Such as, to community associations or service clubs?

Environment

Did you make donations to organizations that preserve the environment? Such as, for conservation efforts, animal protection, or parks?

International

Did you make donations to organizations that provide international aid or promote world peace? Such as, international children's funds, disaster relief, or human rights?

Other

Did you make donations of money, assets, or property to charitable organizations with purposes other than those we just talked about?

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